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INTRODUCTION

A COMPREHENSIVE INFORMATION SERVICE

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Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA*

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Thesaurus should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: heirarchical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

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Federal Republic of Germany

Volume 10 Number 8 / April 23, 1972

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 996
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 998
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 1000
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 1007
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 1012
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 1014
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

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08 Computers 1018
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 1020
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 1023
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 1025
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 1028
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 1032
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 1044
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 1061
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

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18 Materials, Nonmetallic 1072
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19 Mathematics 1076
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 1077
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 1080
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 1083
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

23 Physics, General 1104
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Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

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26 Physics, Solid-State 1117
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27 Propellants 1121
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

28 Propulsion Systems 1122
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 1122
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 1127
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 1133
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 1135
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 1137
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

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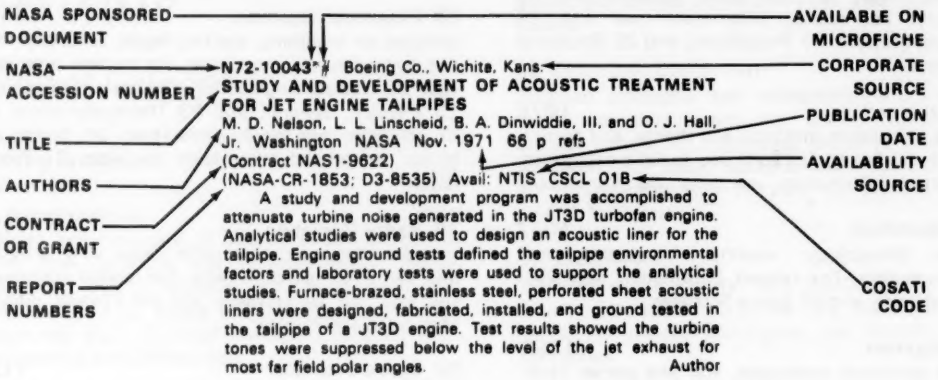
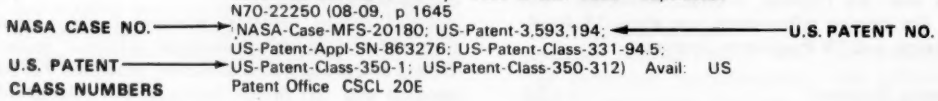


N72-10043*# Boeing Co., Wichita, Kans.
STUDY AND DEVELOPMENT OF ACOUSTIC TREATMENT FOR JET ENGINE TAILPIPES
M. D. Nelson, L. L. Linscheid, B. A. Dinwiddie, III, and O. J. Hall, Jr. Washington NASA Nov. 1971 66 p refs
(Contract NAS1-9622)
(NASA-CR-1853; D3-8535) Avail: NTIS CSCL 01B

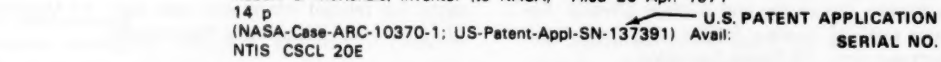
A study and development program was accomplished to attenuate turbine noise generated in the JT3D turbofan engine. Analytical studies were used to design an acoustic liner for the tailpipe. Engine ground tests defined the tailpipe environmental factors and laboratory tests were used to support the analytical studies. Furnace-brazed, stainless steel, perforated sheet acoustic liners were designed, fabricated, installed, and ground tested in the tailpipe of a JT3D engine. Test results showed the turbine tones were suppressed below the level of the jet exhaust for most far field polar angles. Author

PATENT CITATION



N72-12440* Auburn Research Foundation, Inc., Ala.
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA)
Issued 13 Jul. 1971 14 p Filed 2 Oct. 1969 Supersedes N70-22250 (08-09, p 1645
(NASA-Case-MFS-20180; US-Patent-3,593,194; US-Patent-Appl-SN-863276; US-Patent-Class-331-94.5; US-Patent-Class-350-1; US-Patent-Class-350-312) Avail: US Patent Office CSCL 20E

PATENT APPLICATION CITATION



N72-10432*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC INFRARED GASDYNAMIC LASER Patent Application
Robert L. McKenzie, inventor (to NASA) Filed 26 Apr. 1971 14 p
(NASA-Case-ARC-10370-1; US-Patent-Appl-SN-137391) Avail: NTIS CSCL 20E

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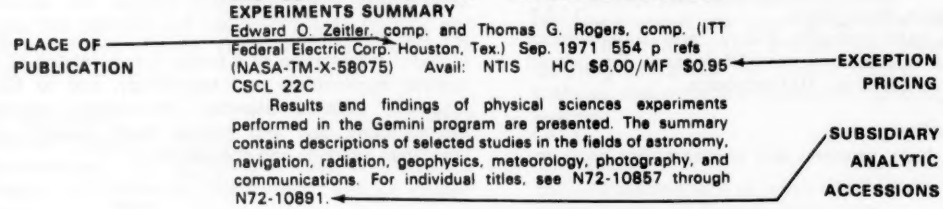

N72-10856*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE GEMINI PROGRAM: PHYSICAL SCIENCES EXPERIMENTS SUMMARY
Edward O. Zeitler, comp. and Thomas G. Rogers, comp. (ITT Federal Electric Corp., Houston, Tex.) Sep. 1971 554 p refs
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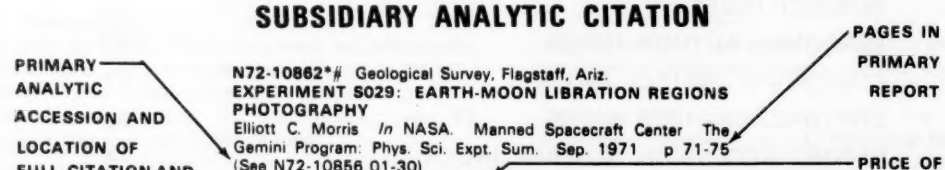
Results and findings of physical sciences experiments performed in the Gemini program are presented. The summary contains descriptions of selected studies in the fields of astronomy, navigation, radiation, geophysics, meteorology, photography, and communications. For individual titles, see N72-10857 through N72-10891.

SUBSIDIARY ANALYTIC CITATION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N72-10862*# Geological Survey, Flagstaff, Ariz.
EXPERIMENT S029: EARTH-MOON LIBRATION REGIONS PHOTOGRAPHY
Elliott C. Morris *In* NASA. Manned Spacecraft Center The Gemini Program: Phys. Sci. Expt. Sum. Sep. 1971 p 71-75
(See N72-10856 01-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 14E

VOLUME 10 NUMBER 8 / APRIL 23, 1972

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N72-16995*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 12, DECEMBER 1971
Dec. 1971 100 p refs
(NASA-SP-7037(12)) Avail: NTIS CSCL 01A

This special bibliography lists 296 reports, articles, and other documents introduced into the NASA scientific and technical information system in November 1971. Emphasis is placed on engineering and theoretical aspects for design, construction, evaluation, testing, operation and performance of aircraft (including aircraft engines) and associated components, equipment and systems. Also included are entries on research and development in aeronautics and aerodynamics and research and ground support for aeronautical vehicles. Author

N72-16996*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 11, NOVEMBER, 1971
Nov. 1971 120 p refs
(NASA-SP-7037(11)) Avail: NTIS CSCL 01A

This special bibliography lists 375 reports, articles, and other documents introduced into the NASA scientific and technical information system in October 1971. Emphasis is placed on engineering and theoretical aspects for design, construction, evaluation, testing, operation and performance of aircraft (including aircraft engines) and associated components, equipment and systems. Also included are entries on research and development in aeronautics and aerodynamics and research and ground support for aeronautical vehicles. Author

N72-16997*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF HINGE MOMENTS FOR A SIMPLE DELTA WING AND A DELTA-WING ORBITER CONCEPT AT MACH 6
George C. Ashby, Jr. Washington Feb. 1972 19 p refs
(NASA-TN-D-6657; L-8103) Avail: NTIS CSCL 01A

Elevon hinge moments were determined from measured surface pressures on a typical delta-wing shuttle orbiter model at selective deflection angles for comparison with the extensive experimental and analytical hinge-moment data previously reported for a simple 75 deg delta wing with a trailing-edge control. The angles of attack were from 0 to 55 deg at elevon deflection angles of -45.5, 0, and 20 deg. The results show that the elevon hinge moments on the shuttle orbiter are essentially the same as those measured earlier for the more basic model. Also included is an appendix describing a cubic spline function technique used to determine the hinge moments from elevon surface-pressure measurements. Author

N72-16998*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL SURFACE PRESSURE DISTRIBUTIONS FOR A FAMILY OF AXISYMMETRIC BODIES AT SUBSONIC SPEEDS
Charles H. Fox, Jr. Washington Dec. 1971 139 p
(NASA-TM-X-2439; L-7926) Avail: NTIS CSCL 01A

An investigation was conducted in the Langley high speed 7- by 10-foot tunnel to determine the surface pressure distributions over a family of axisymmetric bodies. The bodies were composed of conical or ogival noses, cylindrical centerbodies, and boattailed or flared afterbodies. Surface pressure orifices were located along the longitudinal meridian in the vertical (pitch) plane, circumferentially at selected stations, and on the base. The models were tested at Mach numbers from approximately 0.4 to 0.8 through an angle-of-attack range from approximately -4 deg to 20 deg at an angle of sideslip of 0 deg. The results of the study are presented with limited analysis. Author

N72-16999# Federal Aviation Administration, Oklahoma City, Okla.
AIRCRAFT ACCIDENTS INVESTIGATION AND PREVENTION SELECTED REFERENCES
Sep. 1971 187 p
(AD-730979; FAA-Bibliographic-List-4) Avail: NTIS CSCL 01/2

The listing of references was compiled at the request of the Transportation Safety Institute, Aeronautical Center. It up-dates the library's Bibliographic List no. 1 of aircraft accident refereoces dated January, 1964. Indexes and bibliographic lists through 1970 were checked and considerable material prior to 1963 which did not appear in the earlier list has been included, but comprehensive coverage is not claimed. Author (GRA)

N72-17000# Office of Naval Research, London (England).
AERONAUTICS AT GENOA, PISA, AND ROME
Richard D. Mathieu 22 Sep. 1971 16 p refs
(AD-731998; ONRL-R-35-71) Avail: NTIS CSCL 01/2

The basic academic program and some of the aeronautical and aerospace research activities at the following three Italian universities are described briefly: University of Genoa; University of Pisa; University of Rome. Author (GRA)

N72-17001# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.

CORRELATION OF EXPERIMENTAL AERODYNAMIC COEFFICIENTS ON THE BASIS OF CURVE FITTING IN THE THREE-DIMENSIONAL CARTESIAN ALPHA, C SUB N, C SUB m SPACE

Helmut H. Korst and A. L. Addy 13 Jul. 1971 36 p ref

(DA Proj. 1M2-62303-A-214)

(AD-732834; RD-TR-71-16) Avail: NTIS CSCL 12/1

A method is presented for curve fitting experimental aerodynamic normal-force and pitching-moment coefficient data as a function of angle of attack. The method is based on the postulation of the existence of a single (C sub N)-(C sub m)-alpha space curve that has a common offset value of the angle of attack for which the normal-force and pitching-moment coefficients simultaneously vanish. The curve fits in the (C sub N)-(alpha) and (C sub m)-(alpha) planes are based on minimizing the squared error between the fitted curves and the experimental data by proper selection of the curve-fit coefficients and the common angle-of-attack offset value. Author (GRA)

N72-17002# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

BASE PRESSURE ON A STING-MOUNTED CONE MODEL AT ANGLE OF ATTACK AT M INFINITY EQUALS 14.2 Final Report

Kenneth F. Stetson and Edward S. Ojdana, Jr. Aug. 1971 35 p refs

(AF Proj. 706500)

(AD-732890; ARL-71-0130) Avail: NTIS CSCL 16/3

Wind tunnel oil flow experiments on a sharp cone model at free stream Mach number = 14.2 revealed that flow attachment on the sting changed considerably with angle of attack. A flow pattern developed which contained two stagnation regions, one on the leeward meridian and one on the windward meridian. The cross-flow about the sting separated at angles of attack as low as four degrees. The cone base pressures in the leeward region remained essentially constant with increases in angle of attack, whereas the windward region pressures decreased.

Author (GRA)

N72-17003# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.

AN EXPERIMENTAL STUDY OF A FLAT-BOTTOMED SEMI-CIRCULAR WING IN VERY CLOSE PROXIMITY TO THE GROUND Final Report

John N. Pepin, Shelia E. Widnall, and Timothy M. Barrows Sep. 1971 27 p refs

(Contract DOT-c-85-65)

(PB-203602; FRA-RT-72-23) Avail: NTIS CSCL 01C

An experimental investigation of a semicircular wing flying very close to a solid boundary is performed to verify recent analytical results. Comparison is made between first order theory and data through plots of lift coefficient versus angle of attack for various clearances. Reasonable agreement is obtained for these cases within the limitations of the theory. Lift/drag ratio plots are also presented which show the potential of such a technique for support vehicles. A brief outline of the theoretical development is also included to give some insight into the type of analysis which was used. GRA

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N72-17004*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

LF336 LIFT FAN MODIFICATION AND ACOUSTIC TEST PROGRAM

S. B. Kazin and L. J. Volk Washington NASA Dec. 1971 144 p refs

(Contract NAS2-5462)

(NASA-CR-1934) Avail: NTIS CSCL 01B

A NASA-sponsored research program was conducted to investigate life fan noise reduction by configuration modifications. An existing lift fan, the 1.3-pressure-ratio, 36-inch-diameter LF336/A, was the test vehicle. Modifications tested included three outlet stator vane rows (including one with lean), two rotor-stator spacings, and addition of acoustic treatment and acoustic exit louvers. The tests were conducted at the Edwards Flight Test Center, using a test site constructed specifically for acoustic testing. Incorporation of all these modifications reduced the aft quadrant fundamental and second harmonic power levels by 19.6 dB, and 10.7dB respectively, and reduced the 150-foot arc peak PNL by 13.5 PNdB. Author

N72-17005*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DITCHING INVESTIGATION OF A 1/30-SCALE DYNAMIC MODEL OF A HEAVY JET TRANSPORT AIRPLANE

William C. Thompson Washington Feb. 1972 80 p refs

(NASA-TM-X-2445; L-7841) Avail: NTIS CSCL 01B

An investigation was made to determine the ditching characteristics of a heavy jet transport airplane. A 1/30-scale dynamic model was used for the tests which were made with the landing gear retracted and with the landing gear extended in various positions. The test results indicated that the most favorable condition for ditching is a 70 landing attitude with the flaps down 40 deg, a landing speed of 137 knots, the nose gear retracted, and the main gear fully extended. There will most likely be some damage to the fuselage bottom and most of the main landing gear will probably be torn away. Author

N72-17006*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

A STUDY OF THE MARKOV GAME APPROACH TO TACTICAL MANEUVERING PROBLEMS

Sheldon Baron, David L. Kleinman, and Saul Serbin Washington NASA Feb. 1972 82 p refs

(Contract NAS1-9910)

(NASA-CR-1979; Rept-2179) Avail: NTIS CSCL 01B

The results of a study to apply a Markov game approach to planar air combat problems are presented. The underlying approach is reviewed and a sophisticated computer program (MAGPIE) developed to solve the planar problems is discussed. Numerical results for highly idealized versions of the problem are presented with a view towards improving understanding of the basic approach. Typical results in the form of optimal costs, strategies and trajectories are also obtained for a realistic version of the planar combat problem. The solution to this problem demonstrates the feasibility of using the Markov game approach for solving meaningful problems. Analysis indicates, however, that straightforward extension to ,three-dimensional air combat problems may be impractical from the standpoint of the computation time required. Alternative approaches are suggested. Author

N72-17007*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

INVESTIGATION OF AIRCRAFT TIRE DAMAGE AGE RESULTING FROM TOUCHDOWN ON GROOVED RUNWAY SURFACES

Thomas A. Byrdsong, John Locke McCarty, and Thomas J. Yager Washington Mar. 1972 21 p refs

(NASA-TN-D-6690; L-7883) Avail: NTIS CSCL 01C

Simulated landing impact tests were conducted to study chevron-cutting damage to the tread of aircraft tires resulting from touchdown on grooved runway surfaces. The study,

involved impacting new and retreaded tires at several inflation pressures, vertical loadings, and sink rates on concrete and asphalt surfaces having a variety of transversely grooved patterns at ground speeds up to approximately 110 knots. Chevron cutting occurs at the spot on the tire which initially contacts the surface and the damage is the result of the scrubbing action of the tire as it skids over the grooves prior to rotation. The extent of chevron cutting was found to be primarily a function of the airplane ground speed at touchdown - the higher the speed, the greater the damage. Chevron-cutting damage is essentially independent of the grooving patterns generally considered for airport use but is dependent upon the nature of the surface finish. Tests with different tires of the same size also indicate that the tread rubber compounding significantly affects the extent of chevron cutting damage. Author

N72-17008# Federal Aviation Agency, Washington, D.C. Engineering and Manufacturing Div.
AIRCRAFT FIRE DETECTION
1971 217 p Conf. held at Washington, D. C., 16-17 Nov. 1970
(AD-730179) Avail: NTIS CSCL 13/12

A symposium on aircraft fire detector systems was held to familiarize Federal Aviation Administration Regional personnel with the characteristics, capabilities, and limitations of the currently available detector systems. A number of presentations were made by representatives of leading fire detector, helicopter, and small airplane manufacturers, and by representatives of the military and the FAA National Aviation Facilities Experimental Center. All aspects of aircraft fire detection were reviewed. Author (GRA)

N72-17009# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AN ACCURACY EVALUATION OF A TAXI SPEED AND DISTANCE MEASURING DEVICE Final Report, Jan. 1970 - Jun. 1970
Sep. 1971 28 p
(FAA Proj. 320-212-06(X))
(AD-730096; FAA-NA-71-19; FAA-RD-71-53) Avail: NTIS CSCL 01/3

A taxi speed and distance measuring device was evaluated for accuracy. The device used a modified skid detector assembly as a sensor. The skid detector assembly was mechanically coupled to the aircraft wheel and thus sensed wheel rotation. Accuracy measurements were made on the device and it was found to meet design accuracy specification for distance measurement. In two cases, speed errors occured which were in excess of the design specification, but it was felt that this would not degrade the operational usability of the speed measuring equipment. The distance measuring portion of the equipment would require modifications to overcome some limitations before the utility of the distance measuring portion of the device in category 3 conditions could be investigated. Author

N72-17010# TRW Systems Group, Redondo Beach, Calif.
DYNAMIC RESPONSE TESTS OF AN AIR CUSHION SUSPENSION SYSTEM FOR THE LINEAR INDUCTION MOTOR (LIM) OF THE TRACKED AIR CUSHION RESEARCH VEHICLE (TACRV) Final Report
Stephen G. Meisenholder, Herbert R. Graham, and Joseph Birchill Jul. 1971 293 p refs
(Contract DOT-FR-0-0044)
(PB-204440; TRW-17617-6003-RO-00; FRA-RT-72-24) Avail: NTIS CSCL 13F

The air cushion and secondary suspension are designed for the support and guidance of the linear induction motor (LIM) on the 300 mph tracked air cushion research vehicle (TACRV). The tests simulate the motion of the suspension system on the TACRV moving over a guideway with sinusoidal surface irregularities. The test variables included oscillatory excitation amplitude, air supply system admittance, air cushion skirt configuration, and reaction rail flexibility. Test results are compared to theoretical response predictions for both the LIM support and guidance systems. Author (GRA)

N72-17011# Ballistic Research Labs., Aberdeen Proving Ground, Md.
DAMAGE CRITERIA FOR PARKED AIRCRAFT
Robert N. Schumacher Sep. 1971 22 p
(DA Proj. 1T0-61102-A-33-E)
(AD-732427; BRL-MR-2128) Avail: NTIS CSCL 01/3

The report presents three damage categories and their definitions for parked aircraft. Included are recommendations for selecting generic classes of aircraft for both fixed wing and rotary wing configurations. For one of the generic aircraft (fighters) detailed damage criteria for the three damage categories are presented and include the structure and systems that are susceptible and the degree to which they have to be affected. Author (GRA)

N72-17012# Aerospace Systems, Inc., Burlington, Mass.
A STUDY OF TECHNIQUES FOR REAL-TIME, ON-LINE OPTIMUM FLIGHT PATH CONTROL. MINIMUM-TIME TURNS TO A SPECIFIED TRACK Final Report, Nov. 1970 - Jul. 1971
William C. Hoffman and Arthur E. Bryson, Jr. Sep. 1971 59 p refs
(Contract F44620-71-C-0016; AF Proj. 9749)
(AD-732938; ASI-TR-71-4; AFOSR-71-2874TR) Avail: NTIS CSCL 01/2

The initial phase of a study of techniques for real-time, on-line optimum flight path control is described. A review of the historical development of aircraft performance optimization during the past three decades is presented. This review indicates that climbing maneuvers in the vertical plane (zero bank angle) have received considerable study, while relatively little work has been done on turning maneuvers. Real-time, on-line flight path optimization requirements and features, which indicate the need for a better understanding of maneuvers out of the vertical plane, are discussed. The equations of motion for variable-velocity turning maneuvers in the horizontal plane are presented. Necessary conditions are derived for a constant-altitude, minimum-time turn to a specified track and final velocity. The formulation is shown to be a generalization of other recently-published investigations of variable-velocity turns independent of final position, and constant-velocity turns onto a specified track. Numerical solution techniques implemented in a digital computer program for the CDC-6600 computer are described. Example results are included for a supersonic aircraft representative of an early model of the F-4. Variable-velocity optimum turns are found to be significantly faster than the corresponding constant-velocity turns, even though their average velocity is considerably lower. Author (GRA)

N72-17013# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DESIGN OF A HELICOPTER STABILITY AND CONTROL AUGMENTATION SYSTEM USING OPTIMAL CONTROL THEORY M.S. Thesis
Alvin Rudolph Lang Sep. 1971 103 p refs
(AD-732911; GGC/EE/71-13) Avail: NTIS CSCL 01/3

The report presents the design of a helicopter stability and control augmentation system using optimal control techniques. The helicopter used as an example was the Sikorsky H-53, but the design procedure is applicable to other helicopters as well. Only the longitudinal dynamics are considered. A technique is described for the design of multivariable feedback controllers based upon results in optimal control theory. For a specified performance index the feedback controller is obtained by solving the matrix Riccati equation. A model is used in the forward controller such that the response of the model to pilot inputs approximates the desired helicopter response. A fixed gain controller is obtained which may be used over the entire helicopter flight envelope. The results show that optimal control theory can be used to design a helicopter stability and control

augmentation system. Responses obtained may be classified as those which are desirable and yield good handling qualities.
Author (GRA)

N72-17014# Douglas Aircraft Co., Inc., Long Beach, Calif.
A FLIGHT SIMULATOR STUDY OF STOL TRANSPORT DIRECTIONAL CONTROL CHARACTERISTICS Final Report
Robert A. Berg, W. Allen Shirley, Gary L. Teper, and Samuel J. Craig Jun. 1971 136 p refs
(Contract DOT-FA70WA-2395)
(AD-732570; FAA-RD-71-81) Avail: NTIS CSCL 01/3

A systematic investigation was conducted of STOL transport terminal area directional control characteristics to identify the significant considerations and to establish appropriate directional control criteria. The investigation consisted of an analysis of existing data and a moving-base flight simulator transport simulator. The simulator test program covered a broad range of lateral and directional aerodynamic characteristics representative of typical STOL transport aircraft. This effort is the second phase of an extensive STOL simulation program, the first phase of which was devoted to the investigation of lateral control characteristics. The present study revealed the existence of an appreciable interaction between the roll and the heading control tasks which suggests that roll-mode damping requirements should be specified in terms of the heading delay characteristics. Lateral control sensitivity tests were conducted which corroborated the results of the first phase of the program. Author (GRA)

N72-17015# Department of Transportation, Washington, D.C. Office of the Assistant Secretary for Safety and Consumer Affairs.
GENERAL AVIATION SAFETY
15 Sep. 1971 36 p
(PB-202928) Avail: NTIS CSCL 01B

A study was made to analyze those factors contributing to general aviation safety for the purpose of finding ways to reduce current accident rates. The study was to include consideration of existing regulatory policies and practices, organizational matters, and other factors relating to general aviation, primarily with respect to the operation of small airplanes. To limit the area of investigation, general aviation for the study included only those operations conducted on a not-for-compensation or hire basis.
Author (GRA)

N72-17016# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA, US AIR CARRIER OPERATIONS, CALENDAR YEAR 1969
18 Aug. 1971 120 p refs
(PB-203183; NTSB-ARC-71-1) Avail: NTIS CSCL 01B

The publication contains statistical, cause/factor and injury tables, accident rates and the briefs of accidents involving U.S. air carriers and an analysis of the operation and safety record of these carriers by type of power and class of carrier.
Author (GRA)

N72-17017# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCICENT REPORTS: BRIEF FORMAT, SUPPLEMENTAL ISSUE 1969, ACCIDENTS
Jul. 1971 63 p
(PB-202940; NTSB-BA-71-2) Avail: NTIS CSCL 01B

The publication, containing reports of 108 accidents, is a supplemental issue for 1969. The accident reports contained in this issue were delayed pending supplemental data, additional study, or because of difficult areas in the investigation. Twenty-seven of the reports cover foreign registered aircraft accidents that occurred in the United States or its possessions.
Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators, and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N72-17018*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRICAL SUBSYSTEM FOR A 2 TO 15 KILOWATT BRAYTON POWER CONVERSION SYSTEM
James Nestor, Pierre A. Thollot, and Richard C. Bainbridge Washington Feb. 1972 28 p refs
(NASA-TM-X-2495; E-5733) Avail: NTIS CSCL 10A

The Brayton power conversion system is undergoing extensive experimental evaluation. Life and performance tests on individual subsystems and components are being carried on concurrently. A brief description is provided of the power conversion system, with details of the electrical subsystem, its components, and some recent design improvements. Performance was evaluated under design, as well as off-design conditions, in both the transient and steady-state operating modes. Performance characteristics of the electrical components and the complete electrical subsystem are tabulated for several operating conditions. A summary of operating hours is also included. Author

N72-17019*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF SPECIFIC SPEED ON EXPERIMENTAL PERFORMANCE OF A RADIAL-INFLOW TURBINE
Milton G. Kofskey and William J. Nusbaum Washington Feb. 1972 43 p refs Supersedes NASA-TN-D-6182
(NASA-TN-D-6605; E-6349) Avail: NTIS CSCL 21E

The performance of a 12.62-cm tip diameter radial-inflow turbine was investigated over a range of specific speeds from 0.28 to 0.73 at equivalent design speed and pressure ratio. The specific speed range was obtained by using stators with different throat areas. The stators were used with the design rotor, with a rotor exducer extension that reduced the rotor throat area, and with the rotor exducer cut back to increase the rotor throat area. The efficiencies obtained with the three rotor configurations are presented and compared. Author

N72-17020*# Astro Research Corp., Santa Barbara, Calif.
APPLICATION OF ISOTENSOID FLYWHEELS TO SPACECRAFT ENERGY AND ANGULAR MOMENTUM STORAGE Final Report
L. R. Adams Washington NASA Feb. 1972 66 p refs
(Contract NAS7-728)
(NASA-CR-1971; ARC-R-423) Avail: NTIS CSCL 09E

Studies and experiments with the concept for expandable flywheel structures, using isotensoid filament geometry and centrifugal force, are reported. Systems employing the isotensoid flywheel are evaluated in terms of energy density (watt-hr/lb) and angular momentum density (ft-lb-sec/lb) and compared with standard electrochemical storage devices and rigid control-moment gyro wheels. Author

N72-17021# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etude Nucleaires.
EQUIPMENT FOR INTERVENTION IN A RADIOACTIVE ENVIRONMENT
J. Vertut, J. P. Guilbaud, and Ph. P. Kissel Aug. 1971 27 p refs Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6 Sep. 1971
(A/Conf-49/P-617; Conf-710901-456) Avail: AEC Depository Libraries

Many studies carried out so far on mobile machines equipped with manipulators for work under very strong irradiation

conditions have produced a choice of telecommanded or piloted systems to carry out remote-control operations, either in case of accident or for the dismantling of high-a ctivity equipment. The handling strategy which emerges from studies carried out in France and from relations now established on a European scale is reported. The range of machines necessary to cope with the different types of operations both inside and outside the plants are reviewed. This range extends from heavy public workstype machines to the light vehicle carrying precision manipulators. The distance at which these machines are used demands a telecommand technology ranging from the multiconductor cable connection to the Hertzian connection. The experience acquired with a vehicle-borne telemanipulation unit in operation for the last few years is described, including a second-generation machine capable of surmounting large obstacles and a third-generation machine suitable for all terrains, carrying two master-slave manipulators and able to receive a Hertzian connection. Author (NSA)

N72-17022# Brigham Young Univ., Provo, Utah. Dept. of Chemistry.

ELECTROCHEMICAL CELLS USING ALKALI METALS AND CHARGE TRANSFER COMPLEXES Technical Progress Report, 1 May 1967 - 31 Aug. 1971

J. Bevan Ott and J. Rex Goates 31 Aug. 1971 11 p refs
(Contract AT(11-1)-1707)
(COO-1707-12) Avail: NTIS

Electrochemical cells consisting of Na(s), Na(l), or Na-K (l alloy) as anodes and I sub 2 complexed with either pyrene or authracene for cathodes have been prepared. Their emf's are high and their short-circuit currents are low. Their emf's are nearly the reversible value calculated on the assumption that the cell reaction is the formation of an iodide salt from the elements. The cells have a remarkable shelf-life (stability increases with the age of the cell), and they recover quickly their initial emf even after being discharged for long periods of time. Author

N72-17023# Argonne National Lab., Ill. Chemical Engineering Div.

LITHIUM/SELENIUM SECONDARY BATTERY FOR IMPLANTATION Annual Technical Progress Report, 23 Jun. 1969 - 22 Jun. 1970

E. J. Cairns, A. A. Chilenskas, H. Shimotake, R. K. Steunenberg, and A. D. Tevebaugh Sep. 1970 86 p refs Sponsored by AEC and NIH
(PB-202374; ANL-MDAP-70; ATPR-1) Avail: NTIS CSCL 10C

A lithium/selenium battery is being developed as an implantable power source for an artificial heart or heart-assist device. Tests of 7.5-cm dia single cells operating at about 370 C with a paste electrolyte consisting of LiF-LiCl-LiI and LiA102 powder, have yielded energy densities exceeding 0.76 W-hr/sq cm at an average voltage above 1.7 V. This performance is sufficient to permit the construction of a 10-W, 120 W-hr battery weighing about 1.1 kg. An unsealed battery test demonstrated that a battery of five 7.5-cm dia lithium/selenium cells will be capable of at least 12 W of power. In addition, a sealed lithium/selenium battery was operated in an air environment and was found to be relatively insensitive to motion as well as orientation. Author (NSA)

N72-17024# El Power Corp., Santa Ana, Calif.

HIGH ENERGY DENSITY LONG LIFE SECONDARY BATTERY (SILVER-ZINC) BB634 ( )/U Final Report, 31 Oct. 1968 - 15 Oct. 1971

Richard H. Sparks Oct. 1971 129 p
(Contract DAAB07-69-C-0093)
(AD-732495; ECOM-0093-F) Avail: NTIS CSCL 10/3

The purpose of the contract was the design, development, and testing of the silver-zinc battery assembly BB 534 ()/U. This battery assembly is a military-ruggedized design consisting of four (4) BB 461 ()/U batteries stacked side by side in the man-pack configuration. The battery assembly is rated at 24 volts and 9.0 ampere bours or 12 volts and 18.0 ampere-hours. The design goals were successfully accomplished. The environmental tests included vibration, shock, drop tests, and high and low temperature, humidity, immersion, and altitude. In addition these batteries were subjected to a complete range of electrical tests. The final report outlines the design and development program and fully documents the battery assembly design. Complete engineering drawings are included in the final report as well as artist's visualization of the battery assembly. Author (GRA)

N72-17025# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

WHY EJECTORS FOR AIRCRAFT PROPULSION-LIFT SYSTEMS AND WHERE WE STAND Final Report

Richard B. Fancher Aug. 1971 41 p refs
(AF Proj. 7116)
(AD-732842; ARL-71-0140) Avail: NTIS CSCL 13/11

The thrust augmentation, lift augmentation and noise reduction characteristics of compact ejectors make them potentially attractive for propulsion lift systems; however in the past, poor thrust augmentation results have negated the other benefits. This report covers the general characteristics of ejectors pointing out what makes them attractive and why only certain types of ejectors are of interest. It reviews the key requirements for high performance thrust augmentation. It also presents a summary of the performance results achieved thus far and proposes some possible applications for various types of V/STOL aircraft. Author (GRA)

N72-17026# Army Electronics Command, Fort Monmouth, N.J. Electronics Technology and Devices Lab.

ALKALINE CADMIUM ANODE STUDIES

Otto C. Wagner and Robert L. Smith Aug. 1971 23 p refs
(DA Proj. 1T6-62705-A-053)
(AD-732830; ECOM-3462) Avail: NTIS CSCL 10/3

At the present time, the best cadmium anode in terms of maximum utilization of active materials and maximum weight and volume energy densities in nickel-cadmium cells is a sponge cadmium electrode with 5% nickel carbonyl conductor. In addition, this electrode exhibited the best maintenance of electrical capacity during prolonged deep discharge cycling. Ferric oxide, which is a very beneficial cadmium extender in cadmium-air cells and in negative limiting nickel-cadmium cells, was detrimental to the nickel hydroxide cathodes in nickel-cadmium cells after 5 cycles. Other additives, such as an indium expander and a T1 O2 extender, were found to have little affect on the capacity of the cadmium anode. Author (GRA)

N72-17676*# Air Force Cambridge Research Labs., Bedford, Mass.

SOLAR CELL RADIATION RESPONSE NEAR THE INTERFACE OF DIFFERENT ATOMIC NUMBER MATERIALS

E. A. Burke, J. R. Cappelli, L. F. Lowe, and J. A. Wall *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 577-583 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 10A

N72-17714*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE DESIGN OF A SOURCE TO SIMULATE THE GAMMA-RAY SPECTRUM EMITTED BY A RADIOISOTOPE THERMOELECTRIC GENERATOR

Melvin Reier *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 850-852 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 10A

N72-17718*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE PROGRAM AT JPL TO INVESTIGATE THE NUCLEAR

INTERACTION OF RTG'S WITH SCIENTIFIC INSTRUMENTS ON DEEP SPACE PROBES
Vincent Truscello *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 866-873 refs
(See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 10A

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N72-17027*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 95, OCTOBER 1971
Nov. 1971 101 p refs
(NASA-SP-7011(95)) Avail: NTIS CSCL 06E

Subject coverage concentrates on the biological, physiological psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry for the 311 reports consists of a standard citation accompanied by its abstract. Author

N72-17028*# Techtran Corp., Glen Burnie, Md.
RELATIONSHIP BETWEEN CHANGES IN POTASSIUM AND PLASMA MAGNESIUM LEVEL DURING STRESS
P. DiLeo Washington NASA Feb. 1972 5 p refs Transl. into ENGLISH from Boll. Soc. Ital. Biol. Sper. (Italy), v. 43, no. 13, 1967 p 850-852
(Contract NASw-2037)
(NASA-TT-F-14126) Avail: NTIS CSCL 06P

Stress leads to a drop in the magnesium level in the blood plasma and a rise in potassium level and is attributed to an indirect link with the adrenal cortex. Author

N72-17029*# Techtran Corp., Glen Burnie, Md.
THE HUMAN BODY AND VIBRATIONS
Alain Berthoz Washington NASA Feb. 1972 22 p refs Transl. into ENGLISH from Le Recherche (France), v. 2, no. 9, Feb. 1971 p 121-129
(Contract NASw-2037)
(NASA-TT-F-14113) Avail: NTIS CSCL 06P

The mechanical impact of vibrations on biological receptors is summarized. Debilitating mechanisms and their results are examined in view of clinical tests on animals and human subjects. Application to therapeutic and scientific research is also discussed. Author

N72-17030*# Translation Consultants, Ltd., Arlington, Va.
BLOOD SERUM LIPIDS IN YOUNG MEN IN RELATION TO STRESS AND PHYSICAL ACTIVITY
A. Caganova, S. Cagan, V. Simko, and P. Glesk Washington NASA Feb. 1972 23 p refs Transl. into ENGLISH from Bratislav. Lekarske Listy (Bratislava), v. 50, no. 3, Sep. 1968 p 321-336
(Contract NASw-2038)
(NASA-TT-F-14075) Avail: NTIS CSCL 06S

The values of blood serum lipids found in young men 18 to 26 years of age, are reported in relation to acute stress situation and regular sports activites. At the period of stress situation, on the day of an examination, statistically significantly raised values of beta lipoproteins, iodine number, of the beta: alpha lipoprotein ratio and a decrease in alpha lipoproteins were found in comparison with the values obtained in the course of the university term. Between the group of athletes and nonathletes, there were not found such pronounced differences in the levels of blood serum lipids as reported by several authors in literature. A single physical load exerted no substantial influence on blood serum lipids in any of the investigated groups. Likewise, no substantial differences were found between the groups of athletes and nonathletes when serum lipids were studied in the course of the term, in the period of a relative psychic rest. Author

N72-17031*# Scientific Translation Service, Santa Barbara, Calif.
POTASSIUM AND PHYSICAL EXERCISE
M. Mitolo, D. Leone, and E. Vitellio Washington NASA Feb. 1972 25 p refs Transl. into ENGLISH from Boll. Soc. Ital. Biol. Sper. (Italy), v. 42, no. 14, 1966 p 881-885
(Contract NASw-2035)
(NASA-TT-F-14124) Avail: NTIS CSCL 06P

The influence of potassium on the muscles is investigated. Male albino rats were used for the study. It is found that potassium increases the operational time of the muscles. Author

N72-17032*# Scientific Translation Service, Santa Barbara, Calif.
PERCEPTION OF THE RESPIRATORY MEDIUM AND GAS PREFERENCE IN MAN AND ANIMALS
I. S. Breslav Washington NASA Jan. 1972 112 p refs Transl. into ENGLISH of the publ. "Vospriyatiye Dykhatel'noy Sredy i Gazopreferendum u Zhivotnykh i Cheloveka" Leningrad, Nauka, 1970
(Contract NASw-2035)
(NASA-TT-F-649) Avail: NTIS CSCL 06P

The book is devoted to the problem of the perception of the respiratory medium and to the behavioral responses of the organism to its composition changes. A method of active choice of preferred gas mixtures (gas preference) is developed and employed for investigations in animals and man. Particularly, man's ability to detect changes of inspired air gas composition was determined. A physiological analysis of the active choice was performed. The relation between these responses and tuning of the organism with a certain composition of the atmosphere was demonstrated. It was shown that the gas preference method can be applied to the evaluation of physiological adequacy of different respiratory mixtures. Author

N72-17033# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
ON A MODEL OF NEURONAL SPIKE TRAINS
Shunji Osaki and R. Vasudevan Jan. 1972 11 p refs
(Grant GM-16197-04)
(TR-72-1) Avail: NTIS

A stochastic model of neuron firing is proposed in which excitatory and inhibitory events are described by general renewal processes and the neuron fires whenever the total excitation exceeds a given positive threshold value. The interval density between successive neuronal firings which can lead to the calculation of the mean and higher moments of the number of firings in a given interval of time is derived. Author

N72-17034# Brookhaven National Lab., Upton, N.Y.
MEMBRANES, MATERIAL TRANSFER, AND IDEAL TRACER THEORY
Leslie F. Nims Jun. 1971 8 p refs Sponsored by AEC
(BNL-50299) Avail: NTIS

A derivation of ideal tracer theory based upon the concepts of field and resistive forces demonstrates that the local resistance coefficients are positive in sign, while the cross resistive coefficients are all negative. This conclusion follows since the

resistive force vector is directed oppositely from the relative velocity vector. The ratio of the magnitudes of the osmotic to the tracer diffusion coefficient of a resistive barrier to the flow of a given chemical species is greater than one and approaches unity as the concentration of the mobile chemical species in question approaches zero at any plane of observation within the barrier. From the general equations it is possible to obtain practical equations descriptive of actual experimental situations which can be used to estimate the magnitude of the integral exchange coefficient, the resistance coefficient determinable in tracer experiments. The magnitude can be determined from either stationary state or relaxation experiments. Author

N72-17035# California Univ., Berkeley. Lawrence Radiation Lab.

IN VIVORADIOBIOLOGICAL STUDIES OF 910 MeV HELIUM ION BEAM Ph.D. Thesis

Claude Y. L. Chong Aug. 1971 97 p refs
(Contract W-7405-eng-48)
(LBL-314) Avail: NTIS

Both the modified Bragg peak and the plateau portion of the 910 MeV helium ion beam from the Berkeley 184 synchrocyclotron (henceforth abbreviated as peak and plateau respectively) were compared to cobalt-60 gamma rays by using 3 modes of total body exposure to evaluate 3 parameters in each of 4 in vivo systems in 13 to 14 week old female LAF1 mice. The 3 modes of exposure were single dose in air, split dose in air, and single dose under hypoxia, and the 3 parameters evaluated included relative biological effectiveness (RBE) in air, recovery pattern in air expressed as percentage of recovery of the first dose (%R), and oxygen enhancement ratio (OER). The 4 test systems consisted of 6-day animal survival, 30-day animal survival, survival of microscopic intestinal colonies, and survival of macroscopic endogenous spleen colony forming units (CFU). The RBE of peak alpha was significantly greater than unity for all end points of the 4 systems under consideration. On the other hand, plateau-alpha RBE was not significantly different from unity. Author (NSA)

N72-17036# Oak Ridge National Lab., Tenn. Health Physics Div.

PROPER USE OF INFORMATION ON ORGAN AND BODY BURDENS OF RADIOACTIVE MATERIAL

Karl Z. Morgan 1971 22 p refs Presented at Symp. on the Assessment of Radioactive Organ and Body Burdens, Stockholm, 22 Nov. 1971 Sponsored by AEC
(Conf-711104-1; SM-150/50) Avail: NTIS

Applications of data on the uptake and retention of various radioisotopes by human body organs and tissues in establishing maximum permissible values for internal radiation doses are discussed. Criteria used in the development of radiation protection standards by the International Commission on Radiological Protection (ICRP) since 1934 are reviewed. It is postulated that changes in values of maximum permissible concentrations of a number of radioisotopes will be incorporated in the 1973 edition of the ICRP Internal Dose Handbook on the basis of new uptake and retention data. NSA

N72-17037# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

ECOLOGICAL AND ENVIRONMENTAL PROBLEMS IN THE APPLICATION OF BIOMATHEMATICS

Burton E. Vaughan [1971] 29 p refs Presented at 6th Symp. on Mathematical Statistics and Probability, Berkeley, Calif., 19 Jul. 1971
(BNWL-SA-3977-Rev; Conf-710716-1) Avail: NTIS

Biostatistical procedures to delineate the broad range of ecological and environmental problems are reported; they encompass systematized operational analysis, statistical estimation, and some deterministics models of ecological systems. It is shown that energy demands in a projected technical growth rate of about 4% per year for the United States will produce a waste heat in the year 2000 that exceeds total electrical generation as of 1955. Increased need for pesticide use will result in a crop yield increase of only 3-fold at a 10-fold increase of pesticide application. G.G.

N72-17038# California Univ., Berkeley. Lawrence Radiation Lab.

HEAVY ION INDUCED SINGLE AND DOUBLE STRAND BREAKS IN PHIX-174 REPLICATIVE FORM DNA

Ralph Chresten Christensen Aug. 1971 106 p refs
(Contract W-7405-eng-48)
(LBL-28) Avail: NTIS

Radiation damage in phiX-174 replicative form 1 (RF 1) DNA was measured as a function of linear energy transfer (LET), using radiation qualities ranging from that of CO-60 gamma rays to that of highly stripped argon nuclei of average initial charge +16.5 and maximum energy 7.4 MeV/nucleon. Irradiations were performed at room temperature in a highly radioprotective broth to minimize free radical effects. With the exception of deuterons, all ion beams terminated in the continuously mixed samples. Samples were assayed for relative proportions of RF 1 (supercoil), RF 2 (open coil), and RF 3 (linear) DNA configurations, using neutral sucrose gradient sedimentation of tritiated thymidine-labeled phiX-174 RF DNA. Viability of bulk and gradient-separated samples was determined using a spheroplast assay. Total viability radiosensitivity of irradiated samples remained approximately constant over nearly the entire LET range investigated. Author (NSA)

N72-17039# California Univ., Davis. Radiobiology Lab.

[EXTERNAL RADIATION AND INTERNAL EMITTER STUDIES IN RADIOBIOLOGY] Annual Report, Fiscal Year 1971

Jun. 1971 143 p refs
(Contract AT(04-3)-472)
(UCD-472-118; UC-48) Avail: NTIS

The research activities during the fiscal year 1971 are reported. Both external irradiation studies and internal emitter studies are included. Fifty-five references to publications and presentations during the report period are cited. NSA

N72-17040# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.

[RADIOBIOLOGY, BIOCHEMISTRY, ENVIRONMENTAL RADIATION, AND NUCLEAR MEDICINE] Annual Progress Report, period ending 30 Jun. 1971

31 Jun. 1971 165 p refs
(Contract AT(04-1)-GEN-12)
(UCLA-12-815) Avail: NTIS

Research activities in biochemistry, radiobiology, and environmental radiation are reported. Studies center on the effects of radiation in living systems, and radiation uptake in soil and water bodies with subsequent entry into the food-chain ecology resulting in general environmental pollution hazards. G.G.

N72-17041# Wayne State Univ., Detroit, Mich. Dept. of Neurosurgery.

BREAKING STRENGTH OF THE HUMAN SKULL VS IMPACT SURFACE CURVATURE Final Report, 30 Jun. 1970 - 30 Jun. 1971

Voigt R. Hodgson and L. M. Thomas 30 Jun. 1971 65 p refs
(Contract DOT-FH-11-7609)
(PB-204239; DOT-HS-800583) Avail: NTIS CSCL 06E

Forty intact, moist, embalmed, human cadavers were dropped with their heads striking at various locations against several surfaces. Parameters measured and computed include drop height, velocity, force, head accelerations, pulse duration, injury indices, angular acceleration and anthropometry. Frontal plate impact data is compared to that obtained from the Alderson 50 percentile anthropomorphic dummy. The purpose of this research is to obtain impact data at skull fracture level which can be used to set Federal Motor Vehicle Safety Standards. Author (GRA)

N72-17042# Michigan Univ., Ann Arbor. Human Performance Center.
SPATIAL EFFECTS IN VISUAL SELECTIVE ATTENTION
Inge Fryklund Bennett Aug. 1971 79 p refs
(Contract AF 49(638)-1736; ARPA Order-461)
(AD-730924; Rept-08773-87-T; AFOSR-71-2610TR; TR-36) Avail: NTIS CSCL 05/10

In many visual selection experiments, Ss view displays of colored letters and numbers. They are instructed to attend to some stimulus dimension (e.g., row location, color, class) and are cued to report the items indicated by one value (e.g., top row, red color) on that dimension. Accuracy is always highest for row report. Since the items cued by row are spatially connected and easily coded for memory, and those cued by color or class spatially scattered and difficult to code, it cannot be concluded that row selection is more efficient than, say, color selection. In these experiments, selection criterion is held constant, and the spatial arrangement of the targets is varied. In experiment I, Ss reported the identities of the 5 red letters appearing in a 5 x 5 matrix. Four types of target arrangements were tested. Four backgrounds, varying in degree of confusability with the targets, were combined factorially with the four target patterns. The effects of pattern and background and their interaction were highly significant. It is suggested that spatial arrangement per se is not crucial; rather the target pattern serves to control the degree of background interference. Experiments II and III were detection analogs of the Letters background similarity condition of experiment I. The Ss had to report whether an A or a T appeared among the red letters. The results for the pattern types were similar, indicating that there are spatial constraints on visual processing at a level low enough to be tapped in a detection task. Author (GRA)

N72-17043# School of Aerospace Medicine, Brooks AFB, Tex.
POSSIBLE CATARACTOGENIC EFFECTS OF RADIOFREQUENCY RADIATION
Daner R. Reider, David L. Epstein, and John H. Kirk Aug. 1971 12 p refs
(AD-730922; SAM-Review-3-71; SAM-TR-71-24) Avail: NTIS CSCL 06/18

Use of the electromagnetic spectrum for man's benefit has increased tremendously. However, the complete understanding of its potential and real biologic hazards has failed to keep pace. The present threshold limit value for microwaves is the subject of much debate. The eye and lens have been damaged by microwaves experimentally, but the mechanism of damage is as yet unexplained. A preliminary study was performed using radiofrequency exposure and rhesus monkeys. No cataracts were formed at a frequency of 19.27 MHz. Problems involved in future radiofrequency studies, and areas which require further studies, are discussed. Author (GRA)

N72-17044# Naval Aerospace Medical Inst., Pensacola, Fla. Research Lab.
ANNOTATED BIBLIOGRAPHY OF REPORTS: SUPPLEMENT NO. 3, 1 JULY 1970 - 30 JUNE 1971
Catherine F. Kasparek and Christine E. Turner 30 Jun. 1971 30 p refs
(AD-731993) Avail: NTIS CSCL 06/19

Documents published at the Naval Aerospace Medical Research Laboratory (NAMRL), Naval Aerospace Medical Institute (NAMI), since 1 July 1970 are included in this third annual supplement to the annotated bibliography of reports dated 30 June 1968. That bibliography is DDC accession number AD 674914, the first supplement is AD 691 415, and the second supplement is AD 710 764. Contents: Ground based investigations for flight experiments on primates in long duration zero g; Mechanisms underlying the behavior of the organs of equilibrium which result in motion sickness, functional reflex disturbances and other unwanted side effects in navy personnel; Aviation personnel procurement and selection; Predicting fleet effectiveness of Navy and Marine Corps pilots and flight officers; Performance limits under flight disorientation conditions in military pilots; Optimization of auditory performance in naval aviation; Optimization of speech communications in naval aviation; Determine applicability of nuclear emulsions to long-term radiation monitoring in high altitude flights and on space platforms. GRA

N72-17045# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
HUMAN HEAD LINEAR AND ANGULAR ACCELERATIONS DURING IMPACT
Thomas D. Clarke, C. Dee Gragg, James F. Sprouffske, Roger M. Zimmerman (New Mexico State Univ.), William H. Muzzy (Naval Aerospace Med. Res. Lab.), and Edwin M. Trout New York Soc. of Automotive Engr. 1971 15 p Presented at 15th STAPP Car Crash Conf., Coronado, Calif., 17-19 Nov. 1971
(AF Proj. 7231)
(AD-732290; AMRL-TR-71-95) Avail: NTIS CSCL 06/19

Head linear and angular accelerations of humans were investigated during exposure to abrupt linear deceleration. The 14 subjects were restrained with three different restraints: lap belt only, Air Force shoulder harness and air bag plus lap belt. Peak sled decelerations ranged from 7.7 to 10.3 g. The results indicated that peak head angular and linear resultant accelerations were elevated with the air bag in contrast to the Air Force shoulder harness or lap belt only restraints. However, the peak angular and linear accelerations may have less traumatic consequences than the degree of head-neck hyperextension. GRA

N72-17046# Cincinnati Univ., Ohio.
SYNTHESIS OF STERICALLY RIGID CYSTAMINE DERIVATIVES Annual Summary Report, 1 Jun. 1970 - 31 Aug. 1971
R. Marshall Wilson and Douglas N. Buchanan 31 Aug. 1971 23 p refs
(Contract DADA17-69-C-9107)
(AD-732509; ASR-2) Avail: NTIS CSCL 06/15

The possibility exists that the cystamine class of radiation protection drugs may be active only in certain conformations. If this should prove to be the case then cystamine derivatives that are rigidly held in the required conformation may be much more effective radiation protection agents than the freely-rotating cystamine. This investigation has been directed toward the synthesis of bicyclic disulfides that can be converted into sterically rigid cystamine derivatives. The specific synthetic goals of this project are the syntheses of the syn and anti isomers of 8-amino-2,3-dithiabicyclo(3.2.1) octane. Towards this objective a single isomer of 2,3-dithiabicyclo(3-2-1)octan-8-ol was prepared. The synthesis of this alcohol has been improved during the past year through the application of high dilution and depolymerization procedures. The stereochemistry of the hydroxyl group in this bicyclic alcohol has been determined to be syn to the disulfide linkage. A potential precursor for the anti isomer has been obtained in the form of trans-2,trans-6-dithioacetylcyclohex-r-l-yl acetate. The preparations of the p-toluenesulfonate and trifluoromethane-sulfonate esters of syn-2,3-dithiabicyclo(3-2-1) octan-8-ol are described. An extensive investigation of the nucleophilic displacement of these esters indicates that they are either inert or that the disulfide linkage cleaves more easily than the desired displacement of the sulfonate ester. Author (GRA)

N72-17047# Naval Submarine Medical Center, Groton, Conn.
BIOCHEMISTRY OF SUBMARINE AND DIVING STRESS. 2: THE EFFECT OF CHRONIC HYPERCAPNIA ON BLOOD PHOSPHOFRUCTOKINASE ACTIVITY AND THE ADENINE NUCLEOTIDE SYSTEM Interim Report
Michael J. Jacey and Karl E. Schaefer 9 Mar. 1971 14 p refs
(MF Proj. 12.524.006)
(AD-731984; NSMRL-659; NAVMED-MF12.524.006-9028B) Avail: NTIS CSCL 06/19

Phosphofructokinase activity and adenine nucleotide levels were determined in blood of guinea pigs exposed to 15% CO2 in 21% O2, balance N2 for varying periods of time up to one week. Acute exposure produced a decrease in enzyme activity while the chronic phase increased activity without attainment of

control values. These alterations in blood phosphofructokinase activity strikingly paralleled the biphasic changes in blood pH during acute and chronic hypercapnia. These findings demonstrate that blood phosphofructokinase activity is capable of responding to in vivo fluctuations in blood pH. ATP, ADP, AMP, and the energy charge were virtually unchanged during both phases indicating that hypercapnia is characterized by conservation of high-energy phosphates. Author (GRA)

N72-17048# Naval Aerospace Medical Inst., Pensacola, Fla.
RESPONSE FROM AROUSAL AND THERMAL SWEAT AREAS DURING MOTION SICKNESS
Joseph A. McClure, Alfred R. Fregly, Efrain Molina, and Ashton Graybiel Aug. 1971 13 p refs
(MR Proj. 041.01.01)
(AD-731995; NAMRL-1142; NAVMED-MR041.01.01-0120B8) Avail: NTIS CSCL 06/19

The sweat response from the palm (an arousal sweat area) is compared with that from the dorsal hand and arm (a thermal sweat area) during the elicitation of motion sickness by vestibular stimulation. Both palmar and dorsal sweating were detected by using galvanic skin response techniques. In addition, the dorsal sweat response was monitored by an electrochemical sweat sensor. The palmar sweat response is maximal during the first few head movements while a subject is rotating at constant velocity and quickly declines with continuation of the stimulus. This is typical of the arousal sweat response seen on the palm of the hand in response to any unusual sensory input. On the other hand, dorsal sweating has a definite latency, followed by a gradual increase in magnitude of the response. This is characteristic of most motion sickness symptomatology. With two of the eight subjects an increase in environmental temperatures was required to obtain a dorsal sweat response. This suggests that the neural activity evoked by vestibular stimulation is superimposed on that already existing as a result of the thermal state. Author (GRA)

N72-17049# Oregon State Univ., Corvallis. Radiation Center.
IONIZATION IN MICROSCOPIC VOLUMES IRRADIATED BY ENERGETIC PHOTONS Final Report
Leslie A. Braby and William H. Ellett 10 Oct. 1971 166 p refs
(Contract N00014-67-A-0369-0006; NR Proj. 105-515)
(AD-731709) Avail: NTIS CSCL 06/18

The energy absorbed by microscopic volumes exposed to ionizing radiation is not well represented by the average dose due to the small number of discrete energy transfers involved. The energy deposited in a microscopic volume can be determined by measuring the ionization in a detector filled with gas at low pressure. A grid-walled spherical proportional counter suitable for making such measurements for photon irradiation is described and compared to a solid-walled counter. Measured ionization distributions are presented for 60Co gamma irradiation, filtered and unfiltered 250 kVp X-rays, and for 65 kVp X-rays. Other distributions which may be of use in understanding radiation damage models are calculated from these measured distributions. Author (GRA)

N72-17050# California Univ., Los Angeles. Dept. of Psychology.
CENTER FOR COMPUTER-BASED BEHAVIORAL STUDIES Semiannual Technical Report, 1 Jan. - 30 Jun. 1971
Gerald H. Shure 31 Jul. 1971 72 p refs
(Contract F30602-70-C-0016; ARPA Order 1488)
(AD-731859; SATR-4) Avail: NTIS CSCL 05/10

The Center for computer-based Behavioral Studies (CCBS) on the UCLA campus is designed and will be developed to overcome a number of the methodological limitations blocking significant research advances in, and behavioral sciences contributions to, the study and analysis of national policies and problems. The Center is to be designed around a time-shared computer system that will make its informational and technological resources available to behavioral scientists and policy analysts located at widely dispersed university and research centers, offering them new and powerful research, policy planning, and educational tools. A number of these tools for studying and analyzing the behavior of individuals, groups, and social-political units are specifically relevant to help bridge the enormous gap that continues to exist between the policy analyst and the behavioral scientist. An essential part of the development of these broad methodological and technological areas is an ongoing program of substantive research on bargaining the conflict resolution behavior relevant to political crisis management. With the three areas of development (laboratory gaming and simulation research, inductive data analysis, and data resources management) sharing a common and systematic base of operation, the potentials for mutual support among them will be substantially enhanced. Central to all of these activities are plans based on a number of highly integrated software systems, hardware configurations and laboratory design and equipment requirements, stemming from ARPA supported research and development projects conducted over the past six years. Author (GRA)

N72-17051# North Carolina Univ., Chapel Hill. Dept. of Psychology.
GROUP BEHAVIOR IN A SIMULATED PANIC SITUATION Final Report, Oct. 1966 - Oct. 1971
Duane P. Schultz 15 Oct. 1971 9 p refs
(Contract N00014-67-C-0131; NR Proj. 120-274)
(AD-731741) Avail: NTIS CSCL 05/10

Research and theoretical efforts attempting to define the causes and nature of panic are reviewed briefly. Topics covered include the incidence of panic as a function of personality variables, the nature of the group, and the type and age of the subjects studied. Two different experimental approaches to the study of panic are described; a laboratory simulation and a role-playing approach. The most clear-cut finding involves subject age. The findings suggest that those who panic may be high in pain sensitivity and that low cohesive groups may be more inclined to panic than high cohesive groups. Particular attention has been paid to practical, theoretical, and ethical issues involved in the conduct of research using human subjects, with reference to the present studies as well as all psychological research. GRA

N72-17052# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
EXPOSURE OF MARIGOLD (TAGETES) TO GASEOUS HYDROGEN CLORIDE Final Report, 6 Nov. 1970 - 2 Jun. 1971
Christopher T. Lind and Sheldon A. London Sep. 1971 19 p refs
(AF Proj. 630204)
(AD-732195; AMRL-TR-71-90) Avail: NTIS CSCL 06/3

To ascertain the extent of environmental pollution problems attendant with Air Force missile operations, mature flowering marigold plants were exposed to one of the known exhaust products, hydrogen chloride. All plants died after 5 minutes exposure to 2071 ppm the highest concentration used. At 95 ppm no effect was noted. Seeds obtained from the exposed plants did not appear to be affected by the HCl treatment. Author (GRA)

N72-17053# Naval Aerospace Medical Inst., Pensacola, Fla.
CENTRAL NERVOUS SYSTEM EFFECTS AS MEASURED BY REACTION TIME IN SQUIRREL MONKEYS EXPOSED FOR SHORT PERIODS TO EXTREMELY LOW FREQUENCY MAGNETIC FIELDS
James D. Grissett and John DeLorge 10 Aug. 1971 16 p refs
(AD-731994; NAMRL-1137) Avail: NTIS CSCL 06/18

The U.S. Navy has current interest in electromagnetic radiation including the extremely low-frequency (ELF) region. The Navy has begun a major research effort to scientifically document any physiological effects which these fields can have on man and his ecology. This present experiment was designed to detect any acute instantaneous central-nervous-system effects

resulting from exposure to an ELF magnetic field. Reaction-time measurements were taken on three squirrel monkeys for 37 one-hour daily sessions. No significant changes in these measurements were observed between control sessions and sessions in which the animals were exposed to 3 Gauss at 45 Hz or to a field of 3 Gauss at 7 Hz. Two other indices of performance, reinforcement ratio and efficiency ratio, were also unchanged. The small number of subjects does not permit a firm conclusion; however, the evidence indicates that the magnetic field did not produce a central-nervous-system response measurable by the technique employed in this study.
Author (GRA)

N72-17054# Naval Ordnance Lab., White Oak, Md.
EXPOSURE RATES FROM EXPERIMENTALLY FRACTIONATED FISSION PRODUCTS
Leland R. Bunney and Daniel Sam 2 Sep. 1971 16 p refs
(Contract DAHC20-70-C-0283)
(AD-732375; NOLTR-71-154) Avail: NTIS CSCL 06/18

Exposure rates, at three feet above a uniformly contaminated smooth plane, were calculated from recent experimentally measured gamma-ray spectra of fractionated products of thermal-neutron fission of 235U. The fractionation had been carried out by very early removal of the rare gas fission products in a reproducible manner. The exposure rates were obtained at nine selected times (1/4, 1/2, 1, 2, 5, 10, 24, 48 and 72 hours) after fission. The photon energy of the gamma-rays released were calculated and are tabulated. Author (GRA)

N72-17055# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECTS OF HIGH G FORCES ON THE VESTIBULO-OCULAR COUNTERROLL REFLEX OF RHESUS MONKEYS M.S. Thesis
Richard H. Wheeler Jun. 1971 89 p refs
(AF Proj. 7222)
(AD-730156; GE/EE/71S-5) Avail: NTIS CSCL 06/19

A model of the vestibulo-ocular reflex manifest by counterroll was used to determine the effects of high G forces on the response of the vestibular system of rhesus monkeys. Baseline data for determining model parameters were generated prior to subjection to high Gs. After subjecting monkeys to high G, the tests were again run to determine if significant changes had occurred in the model's parameters. The tests consisted of constant speed rotation, pendular oscillations and multiple sine wave oscillations about their line-of-sight. Counterroll was recorded using a linear resolver mechanically fixed to the monkey's eyeball and the data collected analyzed by use of the Fast Fourier transform. The results of this study indicate that the response is not significantly affected by G loading as high as 70G. Author (GRA)

N72-17057# Joint Publications Research Service, Washington, D.C.
CONDITIONS AND PRINCIPAL RESULTS OF RADIOBIOLOGICAL RESEARCH
Yu. G. Grigoryev, V. N. Benevolenskiy, and Yu. P. Druzhinin *In its* Space Biol. and Med., v 5, no. 6, 1971 4 Feb. 1972 p 1-9 refs (See N72-17056 08-05)
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N72-17058# Joint Publications Research Service, Washington, D.C.
POSTFLIGHT MUTABILITY AND STATE OF THE SEX FACTOR IN E COLI K-12
A. A. Lukin and G. P. Parfenov *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 10-14 refs (See N72-17056 08-05)
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N72-17059# Joint Publications Research Service, Washington, D.C.
PERSISTENCE OF THE RADIATION EFFECT IN YEASTS IRRADIATED BY GAMMA QUANTA ON EARTH AND IN SPACE
V. N. Benevolenskiy, Yu. G. Kapultsevich, V. I. Korogodin, and S. A. Chepelev *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 20-26 refs (See N72-17055 08-05)
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N72-17060# Joint Publications Research Service, Washington, D.C.
PERSISTENCE OF THE RADIATION EFFECT IN YEASTS IRRADIATED BY GAMMA QUANTA ON EARTH AND IN SPACE
V. N. Benevolenskiy, Yu. G. Kapultsevich, V. I. Korogodin, and S. A. Chepelev *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 20-26 refs (See N72-17056 08-05)
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N72-17061# Joint Publications Research Service, Washington, D.C.
EFFECT OF FLIGHT CONDITIONS ON THE RADIOSENSITIVITY OF HYDROGEN BACTERIA CELLS
V. M. Abramova, V. N. Benevolenskiy, and Yu. P. Druzhinin *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 27-30 refs (See N72-17056 08-05)
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N72-17062# Joint Publications Research Service, Washington, D.C.
CHANGE IN GROWTH PROCESSES IN IRRADIATED LETTUCE SEEDS
Yu. I. Shaydorov, A. T. Miller, I. V. Nikitina, L. V. Alekseyenko, A. O. Krustyn, and V. N. Nekrasova *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 31-35 refs (See N72-17056 08-05)
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N72-17063# Joint Publications Research Service, Washington, D.C.
EFFECT OF FLIGHT FACTORS ON DORMANT LETTUCE SEEDS
Yu Farber, V., L. V. Nevzgodina, N. M. Papyan, and T. N. Soboleva *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 36-45 refs (See N72-17056 08-05)
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N72-17064# Joint Publications Research Service, Washington, D.C.
EFFECT OF FLIGHT FACTORS ON RADIATION DAMAGE TO CHROMOSOMES IN DORMANT PEA SEEDS
L. S. Tsarapkin, L. V. Alekseyenko, and K. A. Tsarapkina *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 46-51 refs (See N72-17056 08-05)
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N72-17065# Joint Publications Research Service, Washington, D.C.
EFFECT OF FLIGHT FACTORS ON THE FORMATION OF ANOMALOUS METABOLITES AND ACTIVITY OF ENZYMES IN PLANTS c04
P. A. Sharkovskiy, A. T. Miller, Yu. I. Shaydorov, and A. O. Krustyn *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 52-56 refs (See N72-17056 08-05)
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N72-17066# Joint Publications Research Service, Washington, D.C.
EFFECT OF SPACEFLIGHT CONDITIONS ON A CHLORELLA CULTURE

T. B. Galkina and I. V. Aleksandrova *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 57-60 refs (See N72-17056 08-05)
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N72-17067# Joint Publications Research Service, Washington, D.C.
STUDY OF THE EFFECT OF FLIGHT FACTORS ON THE ZOND-8 AUTOMATIC STATION ON A CULTURE OF YEASTS AND ALGAL BACTERIA
E. A. Romanova, L. A. Maksimova, L. A. Siletskaya, A. L. Mashinskiy, Ye. A. Krasavin, and V. K. Kovalenkova *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 61-64 refs (See N72-17056 08-05)
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N72-17070# Joint Publications Research Service, Washington, D.C.
EFFECT OF BRIEF SPACE FLIGHTS ON THE HUMAN NEUROMUSCULAR SYSTEM **c04**
L. I. Kakurin, M. A. Cherepakhin, and V. I. Pervushin *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 78-83 refs (See N72-17056 08-05)
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N72-17071# Joint Publications Research Service, Washington, D.C.
EFFECT OF AN ATMOSPHERE WITH A HIGH CARBON DIOXIDE CONTENT ON HUMAN TOLERANCE TO ACUTE HYPOXIA AND ACCELERATION
N. A. Agadzhanyan, Ye. B. Shulzhenko, I. F. Vil-Vilyams, and A. V. Serginenko *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 84-90 refs (See N72-17056 08-05)
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N72-17072# Joint Publications Research Service, Washington, D.C.
DEVELOPMENT OF STAPHYLOCOCCAL INFECTION IN HUMAN SUBJECTS UNDER THE INFLUENCE OF SOME SPACEFLIGHT FACTORS
B. A. Chukhlovin, P. B. Ostroumov, and S. P. Ivanova *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 91-98 refs (See N72-17056 08-05)
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HISTOPATHOLOGIC SUBSTRATE OF ATHEROSCLEROSIS TRANSPIRING WITHOUT SYMPTOMS IN YOUNG PEOPLE
M. L. Kolomiyevskiy *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 99-104 refs (See N72-17056 08-05)
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PHYSIOLOGICAL-HYGIENIC EVALUATION OF REGENERATED DRINKING WATER
L. I. Elpiner *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 112-120 refs (See N72-17056 08-05)
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N72-17077# Joint Publications Research Service, Washington, D.C.
POSSIBILITY OF SYNTHESIS OF PRECURSORS OF COMPLEX ORGANIC COMPOUNDS IN REGIONS OF SUBMARINE VOLCANISM
L. M. Mukhin *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 124-126 refs (See N72-17056 08-05)
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N72-17078# Joint Publications Research Service, Washington, D.C.
POSSIBILITY OF USING A CONDENSATE OF ATMOSPHERIC MOISTURE IN A SYSTEM FOR FUNCTIONING OF HIGHER PLANTS
N. T. Nilovskaya, S. V. Chizhov, Yu. Ye. Sinyak, N. N. Shekhovtsova, M. I. Shikina, L. E. Yegorova, and V. V. Krasnoshchekov *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 127-131 refs (See N72-17056 08-05)
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N72-17617*# Oak Ridge National Lab., Tenn.
CALCULATION OF THE ABSORBED DOSE AND DOSE EQUIVALENT INDUCED BY MEDIUM ENERGY NEUTRONS AND PROTONS AND COMPARISON WITH EXPERIMENT
T. W. Armstrong and B. L. Bishop *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 123-127 refs (See N72-17601 08-22)
(NASA Order H-38280A)
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N72-17618*# Oak Ridge National Lab., Tenn.
PRIMARY AND SECONDARY PARTICLE CONTRIBUTIONS TO THE DEPTH DOSE DISTRIBUTION IN A PHANTOM SHIELDED FROM SOLAR FLARE AND VAN ALLEN PROTONS
R. T. Santoro, H. C. Claiborne, and R. G. Alsmiller, Jr. *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 128-136 refs (See N72-17601 08-22)
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HIGH Z PARTICLE APOLLO ASTRONAUT DOSIMETRY WITH PLASTICS
E. V. Benton and R. P. Henke *In* NASA, Washington Proc. of The Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 149-156 refs Sponsored by NASA (See N72-17601 08-22)
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N72-17622*# California Univ., La Jolla. Dept. of Radiology.
FLUCTUATIONS IN ENERGY LOSS AND THEIR IMPLICATIONS FOR DOSIMETRY AND RADIOBIOLOGY
Norman A. Baily and John E. Steigerwalt *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 157-161 refs (See N72-17601 08-22)
(Grant NGL-05-009-103)
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N72-17623*# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
THE MEASUREMENT OF RADIATION EXPOSURE OF ASTRONAUTS BY RADIOCHEMICAL TECHNIQUES
R. L. Brodzinski *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 162-167 refs (See N72-17601 08-22)
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A REVIEW: SOME BIOLOGICAL EFFECTS OF HIGH LET RADIATIONS
Albert Wiley, Jr. *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 223-228 refs (See N72-17601 08-22)
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N72-17630*# Washington Univ., Seattle.
EFFECTS OF X-RAY IRRADIATION ON HUMAN SPERMATOGENESIS
T. W. Thorslund and C. A. Paulsen *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 229-232 (See N72-17601 08-22)
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N72-17631*# Oak Ridge National Lab., Tenn.
MULTIFACTORIAL ANALYSIS OF HUMAN BLOOD CELL RESPONSES TO CLINICAL TOTAL BODY IRRADIATION
John M. Yuhas, T. R. Stokes, and C. C. Lushbaugh *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 233-237 refs Sponsored by AEC and NASA Prepared in cooperation with Oak Ridge Assoc. Univ. (See N72-17601 08-22)
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N72-17632*# Oak Ridge Associated Universities, Tenn.
PULMONARY-IMPEDANCE POWER SPECTRAL ANALYSIS: A FACILE MEANS OF DETECTING RADIATION-INDUCED GASTROINTESTINAL DISTRESS AND PERFORMANCE DECREMENT IN MAN
Robert C. Rick, C. C. Lushbaugh, Earl McDow, and Edward Frome (Emory Univ., Atlanta) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 238-248 refs Sponsored by NASA and AEC (See N72-17601 08-22)
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A MODULAR APPROACH FOR ASSESSING THE EFFECT OF RADIATION ENVIRONMENTS ON MAN IN OPERATIONAL SYSTEMS. THE RADIOBIOLOGICAL VULNERABILITY OF MAN DURING TASK PERFORMANCE
Dean E. Ewing *In* NASA, Washington Proc. of Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 364-367 refs (See N72-17601 08-22)
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N72-17653*# Oak Ridge Associated Universities, Tenn. Medical Div.
PREDICTED LEVELS OF HUMAN RADIATION TOLERANCE EXTRAPOLATED FROM CLINICAL STUDIES OF RADIATION EFFECTS
C. C. Lushbaugh *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 398-415 refs Sponsored in part by AEC and NASA (See N72-17601 08-22)
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N72-17655*# California Univ., Irvine. Coll. of Medicine.
ON THE USE OF QUALITY FACTORS AND FLUENCE TO DOSE RATE CONVERSION IN HUMAN RADIATION EXPOSURES
C. A. Sondhaus *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 424-434 refs (See N72-17601 08-22)
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N72-17656*# Columbia Univ., New York. Radiological Research Labs.
METHODS AND APPROACHES TO DOSIMETRY
Harald H. Rossi *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 435-437 refs (See N72-17601 08-22)
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N72-17683*# National Cancer Inst., Bethesda, Md.
FACTORS MODIFYING THE RESPONSE OF LARGE ANIMALS TO LOW-INTENSITY RADIATION EXPOSURE
Norbert P. Page and Edwin T. Still (AEC, Washington, D. C.) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 622-632 refs Prepared in cooperation with AEC, Washington, D. C. (See N72-17601 08-22)
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N72-17684*# Los Alamos Scientific Lab., N.Mex.
EFFECT OF CONTINUOUS GAMMA-RAY EXPOSURE ON PERFORMANCE OF LEARNED TASKS AND EFFECT OF SUBSEQUENT FRACTIONATED EXPOSURES ON BLOOD-FORMING TISSUE
J. F. Spalding, L. M. Holland, J. R. Prine, D. N. Farrer (Aeromed. Res. Lab. (6571st), Holloman AFB, N. Mex.), and R. G. Braun (Aeromed. Res. Lab. (6571st), Holloman AFB, N. Mex.) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 633-640 refs Supported by AEC (See N72-17601 08-22)
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N72-17685*# Civil Aeromedical Inst., Oklahoma City, Okla.
RELATIVE BIOLOGICAL EFFECTIVENESS OF FAST NEUTRONS COMPARED WITH X-RAYS: PRENATAL MORTALITY IN THE MOUSE
W. Friedberg, G. D. Hanneman, D. N. Faulkner, and E. B. Darden, Jr. (ORNL) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 641 (See N72-17601 08-22)
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N72-17686*# Kansas Univ., Kansas City. Medical Center.
PROTON IRRADIATION OF STEM CELLS: RADIATION DAMAGE AND CHEMICAL RADIOPROTECTION
Richard C. Riley, James L. Montour, and Clifford W. Gurney (Med. Coll. of Va.) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 642-646 refs Prepared in cooperation with Med. Coll. of Va., Richmond. Div. of Radiation Biol. (See N72-17601 08-22)
(Grants NGR-47-002-018; AM-14377-02)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

N72-17687*# Michigan Univ., Ann Arbor. Dept. of Zoology.
RADIATION CARCINOGENESIS AND ACUTE RADIATION MORTALITY IN THE RAT AS PRODUCED BY 2.2 GeV PROTONS
C. J. Shellabarger, R. F. Straub, J. E. Jesseph, and J. L. Montour *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 647-651 refs Prepared in cooperation with Brookhaven Natl. Lab., Upton, N. Y. Med. Dept. (See N72-17601 08-22)
(Grant NGR-23-005-009)
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N72-17688*# California Univ., Berkeley. Lawrence Radiation Lab.
RESPONSE OF MOUSE EPIDERMAL CELLS TO SINGLE DOSES OF HEAVY-PARTICLES
J. T. Leith, W. A. Schilling, and G. P. Welch *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 652-658 refs Prepared in cooperation with Calif. Univ., Berkeley. Donner Lab. (See N72-17601 08-22)
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N72-17689*# Medical Coll. of Virginia, Richmond. Dept. of Radiology.
LYMPHATIC INVOLUTION AND EARLY MORTALITY IN

THE YOUNG CHICKEN PRODUCED BY 2.2 GeV PROTONS
James L. Montour and Claire J. Shellabarger *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 659-663 Supported in part by AEC (See N72-17601 08-22)
(Grant NGR-23-005-009)
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N72-17690*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF THE HAZARD FROM EXPOSURE TO ELECTRON IRRADIATION SIMULATING THAT IN THE SYNCHRONOUS ORBIT
Stuart W. Lippincott, Trutz Foelsche, James L. Montour, Roger Bender, and John Wilson *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 665-671 ref Prepared in cooperation with Med. Coll. of Va. and the Citadel, Charleston, S. C. (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

N72-17705*# Martin Marietta Corp., Denver, Colo.
INFLUENCE OF A DETAILED MODEL OF MAN ON PROTON DEPTH/DOSE CALCULATION
Paul G. Kase *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 773-780 refs Sponsored by NASA and Air Force (See N72-17601 08-22)
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N72-17729*# Oak Ridge Associated Universities, Tenn.
DOSIMETRY FOR RADIOBIOLOGICAL STUDIES OF THE HUMAN HEMATOPOIETIC SYSTEM
W. L. Beck, T. R. Stokes, and C. C. Lushbaugh *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 974-981 refs (See N72-17601 08-22)
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N72-17730*# Case Western Reserve Univ., Cleveland, Ohio.
HAIR RADIOACTIVITY AS A MEASURE OF EXPOSURE TO RADIOISOTOPES
W. H. Strain (Cleveland Metro. Gen. Hosp.), W. J. Pories (Cleveland Metro. Gen. Hosp.), R. B. Fratianne (Cleveland Metro. Gen Hosp.)04(Cleveland Metro. Gen. Hosp.), and A. Flynn *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 982-999 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

N72-17732*# California Univ., Berkeley. Lawrence Radiation Lab.
THE HEAVY PARTICLE HAZARD, WHAT PHYSICAL DATA ARE NEEDED?
S. B. Curtis and M. C. Wilkinson (Boeing Co., Seattle) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 1008-1015 refs (See N72-17601 08-22)
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05 BIOTECHNOLOGY

Includes life support systems, human engineering, protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N72-17056# Joint Publications Research Service, Washington, D.C.
SPACE BIOLOGY AND MEDICINE, VOLUME 5, NO. 6, 1971
4 Feb. 1972 139 p refs Transl. into ENGLISH from Kosm. Biol. Med. (Moscow), v. 5, no. 6, 1971 p 1-138
(JPRS-55100) Avail: NTIS

Articles from Russina publications concerning space biology and medicine are presented. Subjects discussed are: (1) selection and training of cosmonauts, (2) evaluation and analysis of data to facilitate the transition from orbital to interplanetary flights, (3) research aimed at guaranteeing safety on long flights and reliability of humans in the spacecraft system, (4) space psychology and physiology, (5) environmental problems and control, and (6) telemetry. For individual titles, see N72-17057 through N72-17078.

N72-17057# Joint Publications Research Service, Washington, D.C.
CONDITIONS AND PRINCIPAL RESULTS OF RADIOBIOLOGICAL RESEARCH **c04**
Yu. G. Grigoryev, V. N. Benevolenskiy, and Yu. P. Druzhinin *In its* Space Biol. and Med., v 5, no. 6, 1971 4 Feb. 1972 p 1-9 refs (See N72-17056 08-05)
Avail: NTIS

An outline of radiobiological investigations, including pre- and postflight irradiation of biological specimens is presented. Experiments performed with dormant yeast cells, hydrogen bacteria, lettuce and pea seeds aboard the Cosmos-368 artificial earth satellite are described. An analysis of certain radiation effects (cell division inactivation, chromosomal aberration induction, growth stimulation and inhibitation reveals no substantial modification of radiation damage in response to nonradiation flight factors. Author

N72-17058# Joint Publications Research Service, Washington, D.C.
POSTFLIGHT MUTABILITY AND STATE OF THE SEX FACTOR IN E COLI K-12 **c04**
A. A. Lukin and G. P. Parfenov *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 10-14 refs (See N72-17056 08-05)
Avail: NTIS

An E. coli culture exposed to space flight aboard the Cosmos-368 artificial earth satellite was examined for the presence of auxotrophic and thermolabile mutants, as well as for the state of the sex factor. No mutants were detected either in the experiment or in the control. No disintegration of the sex factor from the bacterial chromosome was detected. Author

N72-17059# Joint Publications Research Service, Washington, D.C.
PERSISTENCE OF THE RADIATION EFFECT IN YEASTS IRRADIATED BY GAMMA QUANTA ON EARTH AND IN SPACE **c04**
V. N. Benevolenskiy, Yu. G. Kapultsevich, V. I. Korogodin, and S. A. Chepelev *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 20-26 refs (See N72-17055 08-05)
Avail: NTIS

During the flight experiment of Cosmos-368 satellite a study was made of the effect of specific flight factors on preirradiated yeast cells Saccharomyces ellipsoides, strain Megri 139-B. The 6-day space flight produced insignificant effects on the occurrence and development of previously existing damage. Prolonged storage of cells in a state of inhibited metabolism influenced the radiation effects to a greater extent. Author

N72-17060# Joint Publications Research Service, Washington, D.C.
PERSISTENCE OF THE RADIATION EFFECT IN YEASTS IRRADIATED BY GAMMA QUANTA ON EARTH AND IN SPACE **c04**

V. N. Benevolenskiy, Yu. G. Kapultsevich, V. I. Korogodin, and S. A. Chepelev *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 20-26 refs (See N72-17056 08-05)
Avail: NTIS

During the flight experiment of Cosmos-368 satellite a study was made of the effect of specific flight factors on preirradiated yeast cells Saccharomyces ellipsoides, strain Megri 139-B. The 6-day space flight produced insignificant effects on the occurrence and development of previously existing damage. Prolonged storage of cells in a state of inhibited metabolism influenced the radiation effects to a greater extent. Author

N72-17061# Joint Publications Research Service, Washington, D.C.
EFFECT OF FLIGHT CONDITIONS ON THE RADIOSENSITIVITY OF HYDROGEN BACTERIA CELLS **c04**
V. M. Abramova, V. N. Benevolenskiy, and Yu. P. Druzhinin *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 27-30 refs (See N72-17056 08-05)
Avail: NTIS

Investigations were carried out to determine the effect of flight conditions and prolonged ground storage on the viability and radiosensitivity of Hydrogenomonas eutropha, strain Z-1, exposed as an aqueous suspension. Radiosensitivity was measured during pre and postflight exposures to cobalt 60 gamma radiation. The absolute number of cells with inactivated division declined slightly and their radiosensitivity decreased as a result of extended (up to 24 days) storage at the temperature of melting ice and at room temperature, including during orbital flight. There was no distinct differences in the radiosensitivity of the Hydrogenomonas bacteria used in the experiment and in the control. Author

N72-17062# Joint Publications Research Service, Washington, D.C.
CHANGE IN GROWTH PROCESSES IN IRRADIATED LETTUCE SEEDS **c04**
Yu. I. Shaydorov, A. T. Miller, I. V. Nikitina, L. V. Alekseyenko, A. O. Krustyn, and V. N. Nekrasova *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 31-35 refs (See N72-17056 08-05)
Avail: NTIS

The effect of spaceflight factors on the biological effectiveness of gamma rays was studied with respect to lettuce seeds. It was found that the flight exerted no significant effect on the energy of seed germination. The length of the primary root in flight specimens irradiated before flight was similar to that in the ground controls. According to this test, flight factors increased the effectiveness of postflight irradiation insignificantly. The influence of a synchronous exposure inhibited the weight of 30-day plants to the greatest extent. The seed exposure to all the doses tested during the flight resulted in a slight decline of plant weight in comparison with the laboratory control. Author

N72-17063# Joint Publications Research Service, Washington, D.C.
EFFECT OF FLIGHT FACTORS ON DORMANT LETTUCE SEEDS **c04**
Yu Farber, V., L. V. Nevzgodina, N. M. Papyan, and T. N. Soboleva *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 36-45 refs (See N72-17056 08-05)
Avail: NTIS

The effect of spaceflight factors on gamma-irradiated and unirradiated lettuce seeds was examined. The experiments were carried out using seeds with normal and increased levels of spontaneous and induced mutagenesis. The flight was shown to influence spontaneous and induced mutagenesis in lettuce seeds. Author

N72-17064# Joint Publications Research Service, Washington, D.C.
EFFECT OF FLIGHT FACTORS ON RADIATION DAMAGE TO CHROMOSOMES IN DORMANT PEA SEEDS **c04**
L. S. Tsarapkin, L. V. Alekseyenko, and K. A. Tsarapkina *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 46-51 refs (See N72-17056 08-05)
Avail: NTIS

Dormant pea seeds with a moisture content of 7.0-7.5 percent exposed before flight to cobalt 60 gamma irradiation in doses of 5 and 10 kilorads were carried aboard the Cosmos-368 artificial earth satellite during the postradiation period. A synchronous experiment was conducted 5 days after the launching. The experiment simulated the changes in the ambient atmosphere aboard the satellite and was also followed by a transport control. Mitotic activity and chromosomal aberrations in anaphase were determined in the root meristem during the first cycle of cell division after wetting. The percentage of dividing cells remained unaltered despite the exposures used. An analysis of the cytogenetic data by the statistical variations method revealed no effects from satellite flight, the ambient atmosphere, and delivery to the launching site. The damage level correlated only with the irradiation doses. Author

N72-17065# Joint Publications Research Service, Washington, D.C.
EFFECT OF FLIGHT FACTORS ON THE FORMATION OF ANOMALOUS METABOLITES AND ACTIVITY OF ENZYMES IN PLANTS **c04**
P. A. Sharkovskiy, A. T. Miller, Yu. I. Shaydorov, and A. O. Krustyn *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 52-56 refs (See N72-17056 08-05)
Avail: NTIS

The effects of flight factors on the formation of anomalous metabolites and activity of enzymes in plants are discussed. Oxidation processes as an important role in the development of primary radiation damage reactions are described. The activity of enzymes as an index of radiation impairment of metabolism in plants is examined. The accumulation of primary radiotoxins due to the activation of oxidative enzymatic processes in the tissues of irradiated plants is investigated. Author

N72-17066# Joint Publications Research Service, Washington, D.C.
EFFECT OF SPACEFLIGHT CONDITIONS ON A CHLORELLA CULTURE **c04**
T. B. Galkina and I. V. Aleksandrova *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 57-60 refs (See N72-17056 08-05)
Avail: NTIS

A Chlorella culture exposed without illumination aboard the Cosmos-368 artificial earth satellite was examined. The postflight study of the cells and their subsequent cultivation in agarized and liquid media gave evidence that the flight induced no significant changes in cell morphology and photosynthetic activity. Author

N72-17067# Joint Publications Research Service, Washington, D.C.
STUDY OF THE EFFECT OF FLIGHT FACTORS ON THE ZOND-8 AUTOMATIC STATION ON A CULTURE OF YEASTS AND ALGAL BACTERIA **c04**
E. A. Romanova, L. A. Maksimova, L. A. Siletskaya, A. L. Mashinskiy, Ye. A. Krasavin, and V. K. Kovalenkova *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 61-64 refs (See N72-17056 08-05)
Avail: NTIS

The results of studying the yeast Candida tropicalis SK-4 and the bacterium Hydrogenomonas eutropha Z-1 which were aboard the automatic station Zond-8 during its lunar flight are presented. The survival of yeast cells during flight and the physiological and biochemical properties of their subsequent generations remained unchanged. The survival of bacteria decreased by 5 percent in comparison with the control. Subsequent generations of bacteria tended to decrease their productivity during autotrophic cultivation, the level remaining within the

limits of productivity variations under laboratory conditions. Bacterial radiosensitivity did not change after the flight. Author

N72-17068# Joint Publications Research Service, Washington, D.C.

USE OF EMBEDDED ELECTRODES AND SENSORS IN CHRONIC EXPERIMENTS ON RATS

N. T. Svistunov, V. M. Garin, and N. I. Kosterev *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 65-70 refs (See N72-17056 08-05)

Avail: NTIS

Electrodes used to register the EMG and ECG, temperature sensors, a special harness fixed to the rat body immediately after operation, as well as procedures for preparing white rats for chronic experiments are discussed. The procedure and harness help to avoid destruction of wires by the animals and to prevent any complications in the postoperation period. Author

N72-17069# Joint Publications Research Service, Washington, D.C.

COORDINATION STRUCTURE OF WALKING OF SOYUZ-9 CREW MEMBERS BEFORE AND AFTER FLIGHT

I. F. Chekirda, R. B. Bogdashevskiy, A. V. Yeremin, and I. A. Kolosov *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 71-77 refs (See N72-17056 08-05)

Avail: NTIS

The cyclogrammetric method was used in studying the structure of walking of Soyuz-9 crew members after recovery. It is shown that the long-duration flight induced rearrangements in the walking structure which involved changes in the intensity and time of controlling impulses sent to the periphery, increases in the number of movement corrections, and other kinematic and dynamic peculiarities. During early readaptation one can discriminate two stages: (1) a stage of a stamping gait, in which the changes are seen visually, and (2) a stage of an impact gait in which the foot evidently impacts the support normally but the cyclogrammetric analysis reveals abnormalities in motor skills.

Author

N72-17070# Joint Publications Research Service, Washington, D.C.

EFFECT OF BRIEF SPACE FLIGHTS ON THE HUMAN NEUROMUSCULAR SYSTEM c04

L. I. Kakurin, M. A. Cherepakhin, and V. I. Pervushin *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 78-83 refs (See N72-17056 08-05)

Avail: NTIS

The results of examinations given to crew members of the Soyuz-3, 4, 5, 6, 7 and 8 are reviewed. The reflex excitability of the neuromuscular system, tone and contractability of the muscles were studied. Space flights of 2 to 5 days in duration brought about an insignificant deterioration in the functional state of the human motor system. This is suggested by changes in neuromuscular excitability in response to a physical load and a dropoff in the tone and strength of skeletal muscles, primarily the postural muscles. Author

N72-17071# Joint Publications Research Service, Washington, D.C.

EFFECT OF AN ATMOSPHERE WITH A HIGH CARBON DIOXIDE CONTENT ON HUMAN TOLERANCE TO ACUTE HYPOXIA AND ACCELERATION c04

N. A. Agadzhanyan, Ye. B. Shulzhenko, I. F. Vil-Vilyams, and A. V. Serginenko *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 84-90 refs (See N72-17056 08-05)

Avail: NTIS

Human tolerance to acute hypoxia and accelerations was studied following exposure to a hypercapnic atmosphere. The reserve time was determined at an altitude of 7,500 meters. Back-to-chest accelerations were imparted on a centrifuge with a large radius. The experimental results show that a many-day exposure to a hypercapnic atmosphere (with a CO2 centration over 30 mm Hg) decreased human tolerance to acute hypoxia and accelerations. Author

N72-17072# Joint Publications Research Service, Washington, D.C.

DEVELOPMENT OF STAPHYLOCOCCAL INFECTION IN HUMAN SUBJECTS UNDER THE INFLUENCE OF SOME SPACEFLIGHT FACTORS c04

B. A. Chukhlovin, P. B. Ostroumov, and S. P. Ivanova *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 91-98 refs (See N72-17056 08-05)

Avail: NTIS

Healthy male test subjects exposed to extended bedrest, partial or complete isolation and inadequate personal hygiene were studied for the size of microbial foci in the nasal mucosa and pathogenicity of nasopharyngeal staphylococci. Most test subjects exhibited an increase in size of staphylococcal foci and an increased presence of staphylococci producing coagulase, hyaluronidase and lecithovitellase. They also exhibited an increased level of antibodies to staphylococcal enzymes in the blood. The carrying of a main phagotype was usually established in isolated groups of subjects. The possibility of mutual infection of human subjects by pathogenic staphylococci under the influence of certain spaceflight factors was demonstrated. Author

N72-17073# Joint Publications Research Service, Washington, D.C.

HISTOPATHOLOGIC SUBSTRATE OF ATHEROSCLEROSIS TRANSPIRING WITHOUT SYMPTOMS IN YOUNG PEOPLE c04

M. L. Kolomiyevskiy *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 99-104 refs (See N72-17056 08-05)

Avail: NTIS

The histologic substrate of atherosclerosis transpiring without symptoms in a young man (24 years old) has histologic elements typical of active atherosclerosis during different stages in its developmental stages demonstrates that in young people the disease has a wavelike development. This also indicates a necessity of preventing the progress and inducing a reversal of the atherosclerotic process by various prevention and therapeutic measures. It is also suggested that hazardous atherosclerotic forms be diagnosed in one's lifetime. Author

N72-17074# Joint Publications Research Service, Washington, D.C.

THERMOTOPOGRAPHY OF THE SKIN IN HEALTHY HUMAN SUBJECTS UNDER COMFORTABLE CONDITIONS

A. Ya. Tizul *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 105-111 refs (See N72-17056 08-05)

Avail: NTIS

Over a 12-month period the temperature of the human skin (thermotopography) was measured at ten symmetric points (forehead, cheek, neck, chest, shoulder, back of hand, stomach, thigh, shin, back of the foot) in 150 healthy male subjects in the age group 24-35 under comfortable conditions. The most thermostable areas of the human body surface were those of the neck, chest, stomach and proximal regions of the limbs and cheeks. The latter areas exhibited distinct seasonal variations with respect to temperature. The determined mean skin thermotopography parameters can be used together with clinical data in studying autonomic-vascular regulation and thermal regulation during body exposure to various stress factors.

Author

N72-17075# Joint Publications Research Service, Washington, D.C.

PHYSIOLOGICAL-HYGIENIC EVALUATION OF REGENERATED DRINKING WATER c04

L. I. Elpiner *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 112-120 refs (See N72-17056 08-05)

Avail: NTIS

The problems involved in producing potable water from

condensates and poorly mineralized water are discussed. A method for correcting the distillate mineral composition is described. It is concluded that good quality potable water can be produced from the calcium-sodium group in the hydrocarbonate class by this method. Author

N72-17076# Joint Publications Research Service, Washington, D.C.
EFFECT EXERTED BY MAN BY ROTATIONS IN THE SAGITTAL PLANE
F. A. Solodovnik and G. F. Khlebnikov *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 121-123 refs (See N72-17056 08-05)
Avail: NTIS

The effect exerted on man by rotation in the sagittal plane is discussed. The subjects were rotated at rates of 60 and 120 degrees per second with accelerations of 12 and 24 degrees per second square, respectively. The duration of a constant angular velocity was 60 seconds. The positive and negative accelerations were equal. After each rotation the subject reported on his feeling of well being and cessation of counterrotation illusion. The results of twenty two experiments using twenty subjects are reported. Author

N72-17077# Joint Publications Research Service, Washington, D.C.
POSSIBILITY OF SYNTHESIS OF PRECURSORS OF COMPLEX ORGANIC COMPOUNDS IN REGIONS OF SUBMARINE VOLCANISM **c04**
L. M. Mukhin *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 124-126 refs (See N72-17056 08-05)
Avail: NTIS

The genesis of life and the origin of complex organic compounds in the regions of submarine volcanoes is discussed. The stability of the synthesized organic compounds is examined. The chemical reactions leading to the formation of reactive molecules which are precursors of biologically important compounds are presented. Author

N72-17078# Joint Publications Research Service, Washington, D.C.
POSSIBILITY OF USING A CONDENSATE OF ATMOSPHERIC MOISTURE IN A SYSTEM FOR FUNCTIONING OF HIGHER PLANTS **c04**
N. T. Nilovskaya, S. V. Chizhov, Yu. Ye. Sinyak, N. N. Shekhovtsova, M. I. Shikina, L. E. Yegorova, and V. V. Krasnoshchekov *In its* Space Biol. and Med., v. 5, no. 6, 1971 4 Feb. 1972 p 127-131 refs (See N72-17056 08-05)
Avail: NTIS

The possibility of purifying a condensate of atmospheric moisture forming in a man-occupied pressure chamber and a greenhouse for the purpose of its repeated use for cultivating plants is discussed. The various methods considered are: (1) sorption, (2) exidative-catalytic, (3) extraction, and (4) lyophilization. The chemical composition of the condensate is examined and the amounts and types of materials present are described. The characteristics of plants in control and experimental groups which were cultivated with the condensate are tabulated. Author

N72-17079*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
A CONTROL-THEORY MODEL FOR HUMAN DECISION-MAKING
William H. Levison and Robert B. Tanner Washington NASA Dec. 1971 112 p refs
(Contract NAS2-5884)
(NASA-CR-1953) Avail: NTIS CSCL 05E

A model for human decision making is an adaptation of an optimal control model for pilot/vehicle systems. The models for decision and control both contain concepts of time delay, observation noise, optimal prediction, and optimal estimation. The decision making model was intended for situations in which the human bases his decision on his estimate of the state of a linear plant. Experiments are described for the following task situations: (a) single decision tasks, (b) two-decision tasks, and (c) simultaneous manual control and decision making. Using fixed values for model parameters, single-task and two-task decision performance can be predicted to within an accuracy of 10 percent. Agreement is less good for the simultaneous decision and control situation. Author

N72-17080*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
STUDY DIRECTED AT DEVELOPMENT OF AN IMPLANTABLE BIOTELEMETRY ION DETECTOR
L. David Hanley and David Kress Nov. 1971 58 p refs
(Contract NAS2-5951)
(NASA-CR-114415; R-701) Avail: NTIS CSCL 06D

A literature search was conducted to currently update known information in the field of ion-selective electrodes. The review attempts to identify present trends in cation and anions selective electrodes pertinent to the area of bioimplantable units. An electronic circuit was designed to provide the high impedance interface between the ion-selective sensors and signal-processing equipment. The resulting design emphasized the need for low power and miniaturization. Many of the circuits were constructed and used to evaluate the ion-selective electrodes. A cuvette capable of holding the ion-selective and the reference electrodes was designed and constructed. This equipment was used to evaluate commercially available ion-selective electrodes and the electrodes designed and constructed in the study. The results of the electrode tests are included. Author

N72-17081*# Becton, Dickinson and Co., Raleigh, N.C.
DEVELOPMENT, FABRICATION AND TESTING OF A MAGNETICALLY CONNECTED PLASTIC VACUUM PROBE SURFACE SAMPLER
G. B. Phillips and V. A. Pace, Jr. Washington NASA Feb. 1972 22 p refs
(Contract NAS1-9887; 191-58-23-01)
(NASA-CR-1947) Avail: NTIS CSCL 06B

The sampler utilizes permanent magnets and soft metal pole pieces to connect the cone/filter assembly to the sampling head and vacuum supply. The cone/filter assembly is packaged in a plastic container and presterilized so that the need for any human contact during the sampling procedure is completely eliminated. Microbiological tests have demonstrated that the sampling efficiency is not affected by the magnetic coupling apparatus and that the probe appears to function as efficiently as the conventional plastic and Sandia vacuum probes. Author

N72-17082# Sandia Labs., Albuquerque, N.Mex. Exploratory Measurements Div.
EYE-CONTROLLED VERSUS HAND-CONTROLLED TRACKING
F. K. Bechtel and J. W. Langenhorst May 1971 62 p refs Sponsored by AEC
(SC-RR-71-0502) Avail: NTIS

A simulator comparison of eye-controlled and hand-controlled tracking reveals no definite superiority of one technique over the other. For small step angular acceleration stimuli, errors are comparable; however, hand-control can maintain track for larger step accelerations than eye-control. On the other hand, for short period triangle-wave angular acceleration stimuli, eye-control yields the smaller peak tracking errors. To its favor, eye-control requires less operator training than hand-control. To its detriment, a field implementation of eye-control is more complex than the hand-control presently in use. By adding a cursor to hand-control, its performance can be improved in those areas where eye-control is superior, but adding the cursor increases the complexity of a field implementation. Author

N72-17083# Columbia Univ., New York. Radiological Research Lab.
[RADIOLOGICAL PHYSICS, BIOPHYSICS, AND RADIOBIOLOGY] Annual Report
1 Jul. 1971 259 p refs
(Contract AT(30-1)-2740)
(NYO-2740-8; TID-4500) Avail: NTIS

Research projects to determine the biological and physiological effects of radium gamma rays are reported. Experiments on the effects of split doses of X-rays on the production of subcapsular opacities in mice were conducted. Inhibition of cell division in hamster cells exposed to a range of low dose rates from radium gamma rays is discussed. Theorems on dose effect relations are described and equations are developed to show the minimum number of events involved in the effect on the cell and the meaning of the slope of the dose effect curve in double logarithmic scale. Author

N72-17084# Texas Technological Univ., Lubbock.
STUDY OF OPTIMAL SPEED ON BICYCLE ERGOMETER
G. Meikandan 1971 57 p refs
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-729831) Avail: NTIS CSCL 06/9

The purpose of the study was to determine the optimal speed of work on a bicycle ergometer. During the experiment the heart rate and oxygen uptake of the subjects while working at different levels of work, load on the dynamometer of bicycle, and speed were monitored. Author(GRA)

N72-17085# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS OF BIONICS, NO. 2 1970 (SELECTED ARTICLES)
E. V. Uteush 9 Jul. 1971 38 p refs Transl. into ENGLISH from Probl. Bioniki (USSR), no. 2, 1970 p 62-67, 107-110, and 131-136
(FTD Proj. 60101)
(AD-730045; FTD-MT-24-57-71) Avail: NTIS CSCL 06/4

Contents: Research on the psychophysiological peculiarities of the operator; Mathematical simulation of functional systems for evaluating remoteness according to the apparent magnitude of the orientator, its gradient, and the apparent velocity; new approach to the analysis, electroencephalograms. GRA

N72-17086# New York Univ., N.Y. Dept. of Psychology.
THE OPTIMAL USE OF SIMULATION Final Report
Joseph Weitz and Seymour Adler Aug. 1971 29 p refs
(Grant AF-AFOSR-1800-69; AF Proj. 9778)
(AD-730951; AFOSR-71-2601TR) Avail: NTIS CSCL 05/10

One hundred subjects were run on a foot-hand-eye coordination task. The apparatus used was a collator. It was set up as a simulator as well as the real task. Twenty subjects (10 male and 10 female) were run in each of five conditions. Condition I - training on collating three pages then transferred to collating eight pages. Condition IA - trained on three pages then overtrained before transferring to eight pages. Condition II - trained on five pages then transferred to eight. Condition IIA - trained on five pages then overtrained before transferring to eight. Condition III - trained immediately on eight pages. For the males, overtraining degraded performance on the transfer trials. This was not true for the females. The closer the training was to the real task (8 pages) the poorer the performance of the males on the transfer performance. Overtraining males who reached criterion early in the initial training had the greater deleterious effect on the transfer trials when compared to those reaching criterion later. This was not true for the females. For the males, no prior training produced the best terminal performance on the transfer task. This was not true for the females. Some suggested explanations of the sex difference are given and some hypothesis are made concerning the optimal use of simulation training. Author (GRA)

N72-17087# BioTechnology, Inc., Falls Church, Va.
THE DEVELOPMENT OF EQUIPMENT FOR PSYCHOMOTOR ASSESSMENT
James H. Sanders, Jr., Lonnie D. Valentine, Jr., and David F. McGrevy Brooks AFB, Tex. AFHRL Jul. 1971 20 p ref
(Contract F41609-70-C-0015; AF Proj. 7719)
(AD-732210; AFHRL-TR-71-40) Avail: NTIS CSCL 05/10

The purpose of the work was to develop a highly flexible psychomotor testing system capable of reproducing the psychological task structure of two electromechanical tests used earlier in Air Force pilot selection programs. These were the SAM Complex Coordination Test and the SAM Two-Hand Coordination Test. The work was conducted in two phases, the first of which resulted in the definition, design, assembly, and testing of the psychomotor testing system. The second phase involved the testing of 120 Air Force pilot candidates and analysis of the data. The system developed to implement these tests consists of two test stations (expandable to eight) and a test control unit. Test control station functions are performed with a PDP-8/L digital computer which can generate graphical, alphanumeric, or point displays on a direct-view storage tube. The feasibility of this psychomotor testing system was demonstrated and found to be highly flexible and efficient, with a capability for conducting test sessions under automated conditions. Author (GRA)

N72-17088# Columbia Univ., New York.
VISUAL PERCEPTION Final Report, 31 Aug. 1968 3 Aug. 1971
Barbara Gillam Lawergren 30 Sep. 1971 33 p refs
(Contract N00014-67-A-0108-0009; NR Proj. 197-009)
(AD-731747; CU-7) Avail: NTIS CSCL 06/16

Research projects in visual perception are presented. Subjects discussed are: (1) Ames window, (2) perceptual grouping, (3) illusions, (4) movement perception, and (5) retinal integration and differentiation. The factors which affect these parameters of visual perception are examined. Author

N72-17089# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SYSTEM DESIGN TRADE STUDIES: THE ENGINEERING PROCESS AND USE OF HUMAN RESOURCES DATA Technical Report, 1 Jan. 1970 - 31 May 1971
Larry M. Lintz, William B. Askren (Air Force Human Resources Lab.), and Wayne J. Lott Wright-Patterson AFB, Ohio Air Force Human Resources Lab. Jun. 1971 104 p refs
(Contract F33615-70-C-1564; AF Proj. 1124)
(AD-732201; AFHRL-TR-71-24) Avail: NTIS CSCL 05/9

The engineering trade study process was investigated to determine the feasibility of including human resources data in trade studies. First, sixty one completed trade studies from actual McDonnell Douglas Corporation aeronautical, missile, and command and control systems were analyzed to determine the characteristics of system design trade studies. Four simulated trade studies containing engineering and human resources data and representing flight control and avionics subsystems then were constructed for experimental use. Seventy two experienced design engineers performed the simulated trade studies. It was found that engineers can and do use human resources data in system design trade studies. Personnel costs and quantities are assigned more weighting in the trade studies than skill types, skill levels and availability of personnel. A detailed presentation of human resources data is given more weighting than is a very condensed presentation. Such data should be presented in tabular form, in quantitative fashion and in units familiar to the engineer to be most useful. The four major sources of variability in trade study results were found to be choice of parameters, weighting factors for the parameters, methods of normalizing the parametric data, and methods of combining parametric data and weighting factors. Air Force standardization of trade study methods is recommended to help overcome this variability. Author (GRA)

N72-17090# Federal Aviation Administration, Washington, D.C. Office of Management Systems.
THE 1970 US CIVIL AIRMEN STATISTICS
Jun. 1971 41 p
(AD-732568) Avail: NTIS CSCL 05/9

Statistics pertaining to airmen, both pilot and nonpilot, were obtained from the official airmen certification records. Data are provided concerning active pilot certificates held, active nonpilot certificates held, and airman certificates issued. GRA

N72-17091# Army Aeromedical Research Lab., Fort Rucker, Ala.
ENGINEERING TEST OF LIGHTWEIGHT UNDERWEAR OF THE WINTER FLIGHT CLOTHING SYSTEM: THERMAL PROTECTION
Francis S. Knox, III, George R. McCahan, Jr., Thomas L. Wachtel, Walter P. Trevethan, Andrew S. Martin, David R. DuBois, and George M. Keiser Jun. 1971 46 p refs
(DA Proj. 3AO-62110-OA-819)
(AD-732429; USAARL-71-19) Avail: NTIS CSCL 11/5

The report describes the use of a bioassay technique to evaluate the fire resistant and thermal protection capabilities of the lightweight underwear of the Army winter flight clothing system. Samples of fabrics were mounted on a template and held in contact with the side of a pig. Thus protected, the pig was exposed to a flame source calibrated to simulate a well developed JP-4 fire. Evaluation of resultant skin burns shows that none of the fabric systems, as evaluated, meet the essential requirement of 10 seconds protection. Author (GRA)

N72-17092# Army Natick Labs., Mass. Clothing and Personal Life Support Equipment Lab.
INVESTIGATION OF METHODS FOR IMPROVING THE FRICTIONAL PROPERTIES OF RUBBER COMPOUNDS USED IN FOOTWEAR
Patrick J. Mahoney Jul. 1971 39 p refs
(DA Proj. 1T0-1101-A-91-A)
(AD-733312; C/PLSEL-88; USANLABS-TR-72-2-CE) Avail: NTIS CSCL 06/17

Efforts to improve frictional qualities entailed the testing of various tread designs, additve materials such as cork and cotton flock, composite specimens, and channeled and siped specimens. Tests were also conducted at room temperature and in some cases at 0F. The data obtained show (1) changes in tread design, composites and coarse additive materials are ineffective in improving friction on smooth surfaces; (2) siping of flat specimens showed slight improvement of friction on wet surfaces; (3) compounds that resist hardening at 0F show better retention of friction at that temperature; and (4) the order of skid resistance of several compounds changes when tested on a different surface. Author (GRA)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N72-17093* Battelle-Northwest, Richland, Wash.
PREPARATION OF HIGH PURITY COPPER FLUORIDE Patent
Jerry R. Lundquist and Robert B. King, inventors (to NASA) Issued 21 Sep. 1971 3 p Field 30 Apr. 1970 Supersedes N70-35104 (08-19, p 3488) Sponsored by NASA
(NASA-Case-LEW-10794-1; US-Patent-3,607,015; US-Patent-Appl-SN-33535; US-Patent-Class-23-88; US-Patent-Class-23-55; US-Patent-Class-23-97) Avail: US Patent Office CSCL 07A

A method is described for producing high purity copper fluoride by heating copper hydroxyfluoride powder in a chamber and subjecting it while hot to flowing fluorine gas.
Official Gazette of the U.S. Patent Office

N72-17094* Stanford Research Inst., Menlo Park, Calif.
PROCEDURE AND APPARATUS FOR DETERMINATION OF WATER IN NITROGEN TETROXIDE Patent
Raffaele F. Muraca, inventor (to NASA) Issued 21 Sep. 1971 6 p Filed 18 Feb. 1969 Sponsored by NASA
(NASA-Case-NPO-10234; US-Patent-3,607,076; US-Patent-Appl-SN-800204; US-Patent-Class-23-230R; US-Patent-Class-23-232C; US-Patent-Class-23-253PC; US-Patent-Class-73-23.1) Avail: US Patent Office CSCL 07D

Nitrogen tetroxide is analyzed for water content by passing it through hot copper contained in a column wherein all nitrogen and hydrogen containing compounds are converted quantitatively to nitrogen and water. The resultant material from the column is then passed into a gas chromatograph whereupon the amount of water initially contained in the nitrogen tetroxide can be determined. Official Gazette of the U.S. Patent Office

N72-17095* Battelle Memorial Inst., Columbus, Ohio.
METHOD FOR DETERMINING PRESENCE OF OH IN MAGNESIUM OXIDE Patent
Ellsworth R. Blosser, Robert B. Iden, and Elton H. Hall, inventors (to NASA) Issued 21 Sep. 1971 4 p Filed 11 Aug. 1969 Supersedes N70-34653 (08 - 18, p 3308) Sponsored by NASA
(NASA-Case-NPO-10774; US-Patent-3,607,080; US-Patent-Appl-SN-848805; US-Patent-Class-23-230; US-Patent-Class-23-201; US-Patent-Class-23-253; US-Patent-Class-73-76) Avail: US Patent Office CSCL 07D

The method consists of heating the MgO in a series of steps of successively higher temperatures, with the final step utilizing an oxygen atmosphere and a temperature above the decomposition temperature of the compound Mg(OH)2 and measuring the amount of water vapor evolved in each step.
Official Gazette of the U.S. Patent Office

N72-17096# Bureau of Mines, Bartlesville, Okla.
MASS SPECTRA AND ANALYTICAL CORRELATIONS FOR 32 ALKYL ARYL SULFIDES
J. E. Dooley and R. F. Kendall 1972 21 p refs
(BM-RI-7604; LC-622.06173; TN23.U7) Avail: NTIS

A mass spectral scheme of analysis was devised which can be used to identify individually a single compound from a larger group of similar compounds. Mass spectra for 32 alkyl aryl sulfides are provided for future reference work, and analytical correlations used in producing the analytical scheme are discussed. Some of the correlations show that base peaks are either the same mass as the parent peaks or may be derived from cleavage alpha to the sulfur atom with migration of one hydrogen to the sulfur atom. Other spectral consistencies provide means of separating ortho-, meta-, and para-tolyl arrangements in an overall analytical scheme. Determinations of chain lengths and separation of isomeric species are also discussed. Author

N72-17097# National Bureau of Standards, Washington, D.C. Microchemical Analysis Section.
MICROCHEMICAL ANALYSIS SECTION: SUMMARY OF ACTIVITIES, JULY 1970 TO JUNE 1971
John K. Taylor, ed. Jan. 1972 78 p refs
(NBS-TN-585) Avail: SOD $0.70 as C 13.46:585

General activities are reported in the areas of air pollution measurement standards including both gases and particulates, in the field of microchemical analysis, in fire research and in electrochemical analysis performed under an international research grant program. A sulfur dioxide standard reference material for use in monitoring ambient atmosphere, and the initial work on a similar standard for stationery sources are described. Research activities on potential standard reference materials for ozone, nitrogen dioxide, and carbon monoxide are also described.
Author

N72-17098# Idaho Nuclear Corp., Idaho Falls.
PROCESS CHEMISTRY FOR BURNER PRODUCT FROM GRAPHITE FUELS CONTAINING NIOBIUM
B. E. Paige and T. L. Evans Jun. 1971 32 p refs
(Contract AT(10-1)-1230)
(IN-1484) Avail: NTIS

A burn-leach process is being developed for reprocessing Rover rocket fuels. Data are reported for an aqueous process for recovering uranium from the HNO3-soluble oxide in the burner product and also from the HNO3-insoluble uranium, Nb3UO10, which forms during combustion. Dissolution rates of Nb3UO10 and of Nb2O5 from overhead product increased with increasing fluoride concentration both for various concentrations of hydrofluoric acid and for mixtures of hydrofluoric acid-nitric acid. Solubility of uranium in the dissolver product and the species precipitated are discussed. A stable region for Nb-Al-F solutions is defined. The corrosion of stainless steel is evaluated with respect to the degree of complexing of the fluoride by niobium. A dilute uranium dissolver product with minimum fluoride-to-niobium mole ratio, completely complexed at 0.4 M aluminum or less, is the best extraction feed from the standpoint of stability and corrosion of extraction equipment. Author (NSA)

N72-17099# Dow Chemical Co., Golden, Colo.
INVESTIGATION OF FLUORINE INTERACTIONS WITH COMMON GLOVEBOX CONSTRUCTION MATERIALS
Louis J. Meile and Ralph O. Wing 13 Sep. 1971 6 p
(Contract AT(29-1)-1106)
(RFP-1739) Avail: NTIS

The interactions between common glovebox construction materials and fluorine gas were investigated to ascertain the potential safety hazards of handling high pressure fluorine within a glovebox system. Construction materials from volatile-fluoride, plutonium recovery gloveboxes were tested in various fluorine and air mixtures at concentrations of 1 to 100 percent. All of the materials tested remained stable in fluorine concentrations of 10 percent, which is the calculated maximum anticipated in the event of a major fluoride release within the prototype gloveboxes. Many test materials spontaneously ignited in fluorine concentrations exceeding 25 percent. Author (NSA)

N72-17100# Mound Lab., Miamisburg, Ohio.
[NUCLEAR CHEMISTRY AND PHYSICS RESEARCH] Progress Report, Oct. - Dec. 1970
30 Jun. 1971 36 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1792) Avail: NTIS

Research progress is reported on: Th-229 recovery, airport cake residues, Po-210 production, rate of change of Pu species concentration in dilute acid solutions, containment of volatile compounds for high-temperature X-ray diffraction, determination of Pu in soil, preparation of tritiated hydrogen gas standards, structural characterization of crystalline dipentaerythritol hexanitrate, X-ray fluorescence of thorium oxide-uranium oxide mixtures, spontaneous fission half-life of Pu-238, differential scanning calorimeter analysis, and determination of plastic cure in molded parts. NSA

N72-17101# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
MAGNETIC PROPERTIES OF SOME ACTINIDE HALIDE COMPOUNDS Ph.D. Thesis - South Carolina Univ., Columbia
M. Elton Hendricks Jul. 1971 195 p refs Sponsored by AEC
(DP-MS-71-46) Avail: NTIS

Magnetic susceptibility measurements on 13 actinide compounds were made with a vibrating-sample magnetometer, mostly in the temperature range 2.5 to 70 K at 10,000 Oe. These compounds were: Cs2NaMCl6 where M is a trivalent actinide, U, Np, Pu, Am, Cm, Bk, the latter two doped into Cs2NaLuCl6; UCl3; NpCl3; PuCl3; PaCl4; UCl4; PuF4; and UBr4. Theoretical calculations, including intermediate coupling and limited J-mixing, were performed for several cases for comparison with experimental magnetic properties. Results for the octahedral compounds include determination of ground levels, observation of small distortion effects, and measurement of limits on crystal-field parameters. Author (NSA)

N72-17102# Central Electricity Generating Board, Berkeley (England).
PURIFICATION OF CARBON MONOXIDE
I. Whittle Aug. 1971 9 p refs
(RD/B/N-2065) Avail: AEC Depository Libraries

A critical review is presented of the methods of purification of CO. Details of the method adopted during the study of the reaction of U with CO are described. Activated charcoal was used to remove O21 and magnesium perchlorate and phosphorus pentoxide to remove water vapor. NSA

N72-17103# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Chemistry and Chemical Engineering.
RECYCLE GEL PERMEATION CHROMATOGRAPHY 3 DESIGN MODIFICATIONS AND SOME RESULTS WITH POLYCARBONATE
J. A. Biesenberger, I. Duvdevani, and M. Tan Aug. 1971 12 p refs Submitted for publication
(Contract N00014-68-A-0131; NR Proj. 356-491)
(AD-732780; TR-32) Avail: NTIS CSCL 07/4

In previous communications, a new recycle device for Gel Permeation Chromatography (GPC) was described and its advantages demonstrated with an analysis of epoxy resins. This device uses a principle which was termed alternate pumping (AP). In the present communication, a modified design for AP recycle is described and some results with a polycarbonate resin are analyzed. This new design differs from the previous one in two major features. It utilizes only one 6-port switching valve and it excludes the refractometer cell from the recycle loop. These features simplify the recycle system and eliminate the problems that were caused by subjecting the refractometer cell to high pressures. Author (GRA)

N72-17104# Army Foreign Science and Technology Center, Charlottesville, Va.
THERMODYNAMIC STUDY OF AN ALUMINUM, OXYGEN AND CARBON SYSTEM AT HIGH TEMPERATURES
M. S. Khrushchev 28 Oct. 1971 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metal. (USSR), no. 6, 1969 p 46-49
(FSTC Proj. T7023012301)
(AD-732774; FSTC-HT-23-428-71) Avail: NTIS CSCL 07/4

The proper selection of solid and gaseous phase combinations of aluminum, oxygen and carbon with respect to the real behavior of these systems at given conditions is very important for thermodynamic analyses of such systems at high temperatures. Graphs of the phase and chemical balances of this phase system at different pressures are given. The graph of chemical and phase balance of the system can be much more accurate when the data concerning the mutual solubility is given. Conditions characterizing the one variant state of the system at various pressures are given. The decrease in pressure in this system moves the solid phase existance areas toward the low temperatures; the increase in pressure shows the contrary influence. GRA

N72-17105# Purdue Univ., Lafayette, Ind.
SOME APPLICATIONS OF MOLECULAR BEAM VELOCITY SPECTROSCOPY TO EVAPORATION AND ENERGY EXCHANGE
S. B. Tang, R. J. Gallagher, and J. B. Fenn Oct. 1971 41 p refs Prepared in cooperation with Yale Univ., New Haven, Conn.
(Contract N00014-67-A-0226-0005)
(AD-732763; Squid-TR-PR-121-PU) Avail: NTIS CSCL 07/4

Velocity distributions have been determined for molecules evaporating into vacuum from surfaces of polycrystalline hexachlorobenzene and sulfur. Analysis of the distributions indicates that they are Maxwellian and correspond to the surface temperature. In the case of sulfur, it appears that more than one

molecular species is involved. It seems likely that the composition of the evaporative flux corresponds to vapor in equilibrium with the solid. Beams from free jets of carbon dioxide as well as methane and its chlorinated derivatives have also been analyzed. Substantial amounts of internal energy survive the expansion and are retained in the beam molecules. Under some conditions it is possible to extract absolute relaxation rates from the velocity spectra. In the case of methane, for example, a value of 15 was obtained for the characteristic rotation-translation collision number. This value is in good agreement with ultrasonic dispersion measurements. Author (GRA)

N72-17106# Louisiana State Univ., Baton Rouge. Dept. of Chemical Engineering.
COMPUTER EVALUATION OF STOCHASTIC AND DETERMINISTIC CONTROLLER DESIGNS FOR A CHEMICAL REACTOR
Edgar C. Tacker, Thomas D. Linton, and Armando B. Corripio Feb. 1971 21 p refs
(Contract F44620-68-C-0021; AF Proj. 7921; Proj. Themis)
(AD-732928; LSU-T-TR-44; AFOSR-71-2944TR) Avail: NTIS CSCL 07/1

The paper was written for the purpose of furnishing some further motivation for process industry practicioners to more fully incorporate the concepts and techniques of modern control and estimation theory in their design methodologies. For the sake of simplicity, attention is restricted to the more elementary notions in modern system theory. Even with this restriction, it turns out that conventional controllers are easily shown to be significantly inferior to controllers designed using modern techniques.
Author (GRA)

N72-17349# National Physical Lab., Teddington (England).
THE FARADAY AND ITS SIGNIFICANCE IN DETERMINING THE FUNDAMENTAL CONSTANTS
A. Horsfield *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 137-145 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17899*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
NEW POLYMER SYSTEMS: CHAIN EXTENSION BY DIANHYDRIDES
R. A. Rhein and J. D. Ingham *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 97-103 refs (See N72-17887 08-30)
Avail: NTIS CSCL 07D

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N72-17107 California Univ., San Diego.
MODE THEORY OF THE WHISPERING-GALLERY GUIDANCE IN THE IONOSPHERE AT HF AND VHF FREQUENCIES Ph.D. Thesis
Hsi-Tien Chang 1970 134 p
Avail: Univ. Microfilms Order No. 70-23043

Propagation between terminals located in the ionosphere is treated using the mode theory. The earth's curvature is taken into account by the method of the modified refractive index. For TE waves in a plane-stratified ionosphere, Maxwell's equations are reduced to an equation similar to the Schroedinger equation in quantum theory. A numeric method of using linear segmented approximation was developed to solve the eigenvalue problem. This technique reduces errors due to reflections from the discontinuities of the conventional step function approximation. Using a Chapman model of ionospheric density, the maximum usable frequency for whispering gallery propagation was found to be about six times the peak plasma frequency for the F region and about fifteen times that for the E region. Scattering by irregularities in the duct is also considered. Dissert. Abstr.

N72-17108 Utah Univ., Salt Lake City.
ANTENNA IMPEDANCE IN THE LOWER IONOSPHERE Ph.D. Thesis
Richard Hugh Bishop 1970 162 p
Avail: Univ. Microfilms Order No. 70-22299

The theoretical behavior of the impedance of a short cylindrical antenna in an ionospheric plasma was investigated as a function of the driving frequency. Plasmas in general and ionospheric plasmas in particular are considered. Methods of measuring various plasma parameters are discussed, with emphasis on RF antenna probes. The impedance of an antenna probe in the lower collision-dominated part of the ionosphere is also considered. The results indicate that the impedance is not a function of the orientation angle between the magnetic field and the antenna axis. The theoretically derived expression for antenna impedance was used to compute the expected impedance at various altitudes in the collision-dominant D region. Dissert. Abstr.

N72-17109* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
COLOR TELEVISION SYSTEM Patent
Olin L. Graham, inventor (to NASA) Issued 7 Sep. 1971 10 p Filed 26 Jun. 1970 Supersedes N70-36005 (08 - 19, p 3501)
(NASA-Case-MSC-12146-1; US-Patent-3,603,722; US-Patent-Appl-SN-50206; US-Patent-Class-178-5.2R; US-Patent-Class-178-5.4; US-Patent-Class-178-6.7) Avail: US Patent Office CSCL 17B

A spring-driven optical filter wheel is rotatably mounted in front of the lens of a monochrone television camera. The wheel includes red, green and blue filter sectors and an opaque sector, the later producing a completely black frame in the resulting video signal. The picture-reproducing apparatus located at the receiving station includes a monochrome television monitor having a second optical filter wheel rotatably mounted in front of the picture tube. A counter counts the vertical sync pulses in the received video signal and advances this second filter wheel at the same rate as the those occurring in the completely single color frames in the video signal. A black frame detector defects the occurrence of a black frame and synchronizes the counter. A gate circuit is controlled by the counter to pass only completely single color video frames to the picture tube. A color film camera exposes a given segment of color film to the individual red, green and blue images following a given black frame to record a full color image on such segment.
Offical Gazette of the U.S. Patent Office

N72-17110# Aeronautical Research Labs., Melbourne (Australia).
DIGITAL RECORDING AMPLIFIERS FOR A MAGNETIC TAPE RECORDER
K. F. Fraser and U. R. Krieser Jun. 1971 12 p refs
(ARL/ME-326) Avail: NTIS

To enable digital data to be recorded, using an Ampex AR200 analog tape machine, two types of plug-in digital amplifiers were developed. Separate amplifiers are used for NRZ data and for RZ data. Author

N72-17111*# Computer Sciences Corp., Falls Church, Va.
SATELLITE BROADCASTING SYSTEM STUDY Final Report
Jan. 1972 269 p refs
(Contract NAS5-21588)
(NASA-CR-122340; Rept-4124-011) Avail: NTIS CSCL 17B

The study to develop a system model and computer

program representative of broadcasting satellite systems employing community-type receiving terminals is reported. The program provides a user-oriented tool for evaluating performance/cost tradeoffs, synthesizing minimum cost systems for a given set of system requirements, and performing sensitivity analyses to identify critical parameters and technology. The performance/costing philosophy and what is meant by a minimum cost system is shown graphically. Topics discussed include: main line control program, ground segment model, space segment model, cost models and launch vehicle selection. Several examples of minimum cost systems resulting from the computer program are presented. A listing of the computer program is also included.
Author

N72-17112*# Stanford Research Inst., Menlo Park, Calif.
INVESTIGATIONS OF HIGH POWER PROBLEMS IN SPACE SHUTTLE ANTENNA DESIGNS
W. C. Taylor and N. J. Alvares Washington NASA Feb. 1972 92 p refs
(Contract NAS1-10068)
(NASA-CR-1922; SRI-8677) Avail: NTIS CSCL 17B

A study program is discussed which includes a survey of industry and government laboratories and was undertaken to determine the state of the art in dealing with problems of high power levels in reentry antenna design. A laboratory program to develop techniques for testing dielectric materials for effects on RF transmission is also considered, with emphasis on high power applications in space and reentry flights. The study program resulted in a set of guidelines for avoiding breakdown in antenna design. A discussion of temperature effects on dielectric breakdown is also given. From the laboratory program, a description is presented of techniques for (1) heating with a carbon arc image furnace, (2) temperature measurement (using thermocouples and an infrared pyrometer), (3) mass spectrometric monitoring of outgassing, (4) testing for RF breakdown in both heated dielectrics and the dielectric/air and dielectric/plasma interfaces. Data and observations are reported from technique development using candidate shuttle materials falling into three categories: (1) lightweight refractory foams, (2) dense RF window materials, and (3) ablative materials.
Author

N72-17113# Goodyear Aerospace Corp., Litchfield Park, Ariz.
RADAR STEREO EQUIPMENT PROGRAM Final Report
Fausto F. Miranda May 1971 50 p refs See also Interim Rept. No. 1, AD-701169
(Contract DAAK02-69-C-0265)
(AD-732875; GERA-1712; Rept-2) Avail: NTIS CSCL 17/9

The purpose of the Radar Stereo Equipment Program was to design and fabricate equipment for the compilation of map contours from side-looking radar imagery. This is the final report and describes the progress made during the course of the program. The equipment was designed to use an analytical stereo plotting concept. A general-purpose computer is used to solve the radar stereo model equations, to control the equipment, and to plot contours on a digital plotter. The optical system of the equipment was specifically designed for radar stereo. To accomplish this end, an appropriate range of zoom magnification was provided, in addition to an anamorphic zoom capability. A positive-negative photo carriage was also provided to allow operation with either same-side or opposite-side stereo.
Author (GRA)

N72-17114# Sandia Labs., Albuquerque, N.Mex.
RESPONSE OF A SHORT MONOPOLE ANTENNA MOUNTED ON THE SKIN OF A FINITE LENGTH CYLINDER
L. D. Licking Sep. 1971 14 p
(SC-RR-71-0519) Avail: NTIS

The response to incident electromagnetic fields of a monopole probe mounted on the side of a cylinder is analyzed. The analysis applies to monopoles and other antennas that are short with respect to a wavelength, with mounting positions on the side or on the end caps of the cylinder. Parametric curves for CW and transient response to a step incident field are given.
Author

N72-17115# Montana Univ., Missoula. Cooperative Wildlife Research Unit.
TRACKING AND TELEMETRY SYSTEM FOR WILDLIFE RESEARCH
Joel R. Varney 1971 6 p refs Presented at the Natl. Telemetering Conf., Washington, D. C., 12 Apr. 1971
(Contract AT(45-1)-1929; Grants NSF 17502; NSF GB-2672; NSF GB-6089)
(RLO-1929-16; Conf-710438-1) Avail: NTIS

Radiolocation and telemetry equipment developed for use in studies of elk and grizzly bear during the past nine years is reported. It is representative of equipment presently being used by many engaged in wildlife research. Most of it is relatively simple and straightforward in terms of the present state of the art in aerospace telemetry, but illustrates some of the special requirements and approaches used for equipment of this type. Areas in which more sophisticated techniques might prove useful are pointed out, and the probable direction of future development is discussed.
Author

N72-17116# Sandia Labs., Albuquerque, N.Mex. Electromagnetic Effects Div.
RECEIVING PROPERTIES OF AN ASYMMETRIC CYLINDRICAL ANTENNA
L. D. Licking Sep. 1971 18 p refs Sponsored by AEC
(SC-RR-71-0475) Avail: NTIS

Asymmetric cylindrical antennas are interesting models for missiles where the metal skin is separated into two parts by a dielectric spacer. An analysis for the response of internal wires in such antennas when illuminated by a plane-wave electromagnetic field is developed. Parametric curves showing short-circuit current and open-circuit voltage responses are given.
Author

N72-17117# Los Alamos Scientific Lab., N.Mex.
WIDE-BAND MAGNETIC-DISK RECORDING OF ANALOG FIELD DATA AND DIGITAL READOUT TO A REMOTE TERMINAL
R. R. Fullwood, L. R. Veeser, and A. L. Marusak Oct. 1971 13 p refs
(Contract W-7405-eng-36)
(LA-4772; DR-1963; UC-37) Avail: NTIS

An analog magnetic-disk recording system, complete with digital readout to a remote terminal, was used during a recent underground nuclear test at the Nevada test site. Dry-run and shot data were digitized and transmitted at 1000 baud by telephone lines to a remote terminal at Los Alamos, New Mexico. The terminal consisted of an on-line computer with a cathode ray tube to display the data and an incremental magnetic tape to record the data in a form suitable for processing at the central computing facility. The bandwidth of the recording was dc to 3 MHz, and the signal-to-noise ratio was 200 to 1. Sixteen data channels and two clock tracks were used.
Author (NSA)

N72-17118# Melpar, Inc., Falls Church, Va.
DEVELOPMENT OF TECHNICAL PERFORMANCE STANDARDS FOR RADIO COMMUNICATIONS-ELECTRONIC SYSTEMS Final Report
Charles O. Forbes, Carl L. Frederick, and Raymond O. Soma Nov. 1970 379 p refs
(Contract OEP-SE-69-103)
(PB-202822) Avail: NTIS HC $6.00/MF $0.95 CSCL 17B

Methodology for the development of standards for communications-electronics equipment leading to improved spectrum utilization is studied.
Author (GRA)

N72-17119# Sachs/Freeman Associates, Inc., Hyattsville, Md.
IDENTIFICATION OF INFORMATION AND ASSOCIATED ANALYTICAL TECHNIQUES FOR THE SOLUTION OF FREQUENCY MANAGEMENT PROBLEMS. VOLUME 2: PROBLEM ANALYSIS APPROACH
Feb. 1971 174 p

(Contract OEP-SE-70-101)
(PB-202686) Avail: NTIS CSCL 17B

The volume presents specific approaches to various problem types using the general capabilities and approach. Hypothetical problems chosen to illustrate various approaches, model requirements, and data needs are developed for several problem categories. Within each category the first illustrative problem has delibrately been simplified to present only the basic approach. In practice many alternatives must be considered and other interference effects may play dominant roles. Statistical properties must also be considered to some degree in most problem solutions but are not employed extensively in the examples.
Author (GRA)

N72-17120# Sachs/Freeman Associates, Inc., Hyattsville, Md.
IDENTIFICATION OF INFORMATION AND ASSOCIATED ANALYTICAL TECHIQUES FOR THE SOLUTION OF FREQUENCY MANAGEMENT PROBLEMS. VOLUME 1: SUMMARY AND RECOMMENDATIONS
Feb. 1971 69 p
(Contract OEP-SE-70-101)
(PB-202685) Avail: NTIS CSCL 17B

A discussion is presented of a general approach to technical analysis including the basic characteristics of the automated systems and data bases required for frequency management analyses operating on large volumes of background information. A general approach to the applications of such resources to problem solving analyses is also presented. Presented are recommendations for the acquisition and use of existing data and models as well as for the development of new data and models. Both short and long range requirements are considered.
Author (GRA)

N72-17121# Versar, Inc., Springfield, Va.
AN INVESTIGATION CONCERNING CONCISE MEASURES OF ELECTROMAGNETIC COMPATIBILITY AND THEIR APPLICATION TO A DECISION RULE FOR SPECTRUM MANAGEMENT Final Report
T. A. Pendleton and J. R. Vaiil May 1971 63 p refs
(Contract OTP-SE-71-101)
(PB-202684) Avail: NTIS CSCL 17B

It is shown that useful a priori measures of the electromagnetic compatibility to be expected from particular telecommunications equipments are obtainable only within the framework of an equipment-oriented interference prediction model and, further, that such a construction appears to be a fundamental necessity for operationally effective spectrum management. Thus, the criteria for meaningful interference prediction are defined, model components and input parameters satisfying these criteria are formulated, and an interference prediction model is developed and analyzed. Author (GRA)

N72-17122# Office of Telecommunications Management, Washington, D.C.
TECHNICAL STANDARDS, MINIMUM PERFORMANCE REQUIREMENTS, AND DESIGN OBJECTIVES APPLICABLE TO TRANSMITTERS, RECEIVERS, AND ANTENNAS USED IN US GOVERNMENT RADIO STATIONS
Jan. 1972 37 p
(PB-204267; OTP-EOP-72-1) Avail: NTIS CSCL 17B

The report contains frequency tolerance table; spurious emission table; radar design objectives and engineering criteria; standards for operations in the bands 29.89 to 42.00, 156 to 174, and 406 to 420 MHz; desired relationship of occupied bandwidth to necessary bandwidth; and minimum performance requirements for single sideband equipments in the band 230 MHz. Author (GRA)

N72-17123# Rochester Univ., N.Y. Dept. of Electrical Engineering.
METHODS OF WIDEBAND SIGNAL DESIGN FOR RADAR AND SONAR SYSTEMS Ph.D. Thesis
Richard Alan Altes 1970 270 p refs
(Contract N66001-69-C-1510)
(AD-732494) Avail: NTIS CSCL 17/9

The radar problem is generalized to wideband signals and receivers. This generalization necessitates consideration of a wideband ambiguity function and of distributed targets. System design methods, using newly-discovered properties of the wideband ambiguity function, the trajectory diagram, and computerized clutter suppression techniques, are established. The application of these methods, combined with distributed target and accelerating target considerations, reveals signals that are optimally tolerant to doppler, acceleration, and distributed target effects. These signals are compared with those used by several species of bats. Author (GRA)

N72-17124# Naval Training Device Center, Orlando, Fla.
FM SONAR SIMULATION TECHNIQUES Final Report
Matthew F. Borg and Francis Murphree Feb. 1971 38 p refs
(AD-732463; NAVTRADEVCEN-1H-184) Avail: NTIS CSCL 05/9

The report outlines technical areas needed for the development of a Continuous Transmission Frequency Modulated Sonar Operator Trainer. The report discusses the contents of a possible standardized active sonar equation to be used in the mathematical modeling of the transmitted and received signal. There is also outlined a hybrid computer technique for producing artificial signals to stimulate the display consoles with dynamic sonar echo returns of mine, non-mine and subterranean targets and features. Author (GRA)

N72-17125# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
THE MODIFIED SHORT BACKFIRE ANTENNA Final Technical Report, Jan. - Jul. 1971
Finn A. Hass 17 Aug. 1971 44 p refs
(Contract DAJA37-71-C-2780; DA Proj. 2O6-1102-B-31-E)
(AD-732506; R-92; ERO-E-1451; S204; R92) Avail: NTIS CSCL 09/5

Measurements have shown it possible to increase the gain of the short backfire antenna significantly in different ways: (1) By increasing the size of the reflectors. (2) By placing extra reflectors in multiples of a half wavelength from the surface wave reflector. (3) By placing a quarter-wave ring in front of the surface of the wave reflector. The surface of the ring is perpendicular to the reflector and the ring has the same diameter as the reflector. The distance between the ring and the reflector giving maximum gain depends on the size and the number of the reflectors. The choice of parameters (size of reflectors) was based on numerical calculations using a theory developed by Drago Neilsen and Pontoppidan at the contracting laboratory. Measurements have shown a decrease in impedance bandwidth product. The levels of the backward lobe and the side lobes are increased, too, but the levels are kept at an acceptable height due to the influence of the quarter-wave ring. The beamwidths in E- and H-plane tend to be equal with increasing gain. This is an advantage if circular polarization is wanted. The modified short backfire antenna has a higher gain than any other backfire antenna of the same size (same length and diameter of the surface wave reflector). The antenna is easy to construct. Author (GRA)

N72-17126# Lincoln Lab., Mass. Inst. of Tech., Lexington.
STUDY OF ANTENNA PATTERN COUVERAGE FOR A UHF ANTENNA SYSTEM ON AN AIRCRAFT
Alan J. Simmons 13 Sep. 1971 33 p refs
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-732291; TN-1971-41; ESD-TR-71-263) Avail: NTIS CSCL 09/5

An idealized study of theoretical patterns of a four-element crossed-slot array on a cylinder approximating the fuselage of a KC-135 aircraft has been carried out. The objective is to obtain complete hemispherical coverage with at least 6 dB gain for circular polarization over the band from 250 to 400 MHz. The

study shows that 15 beam positions, requiring switching each antenna between 0 degrees and three values of phase shift, will give nearly the desired coverage. Coverage is limited over a small portion of the region, primarily in the fore-aft directions, because of the drop in gain of the individual array elements in these directions. An optimum location for the array on the side of the fuselage is chosen at an angle of 60 degrees from the zenith. A similar array is required on the opposite side of the aircraft to give coverage on the other side. The effects of multipath reflections are calculated and found to bb negligible because of the circular polarization discrimination of the antenna.
Author (GRA)

N72-17127# Aerospace Corp., El Segundo, Calif.
MICROWAVE BREAKDOWN ON A SYMMETRICALLY EXCITED CONICAL REENTRY VEHICLE
Keith M. SooHoo, Glenn C. Light, and John E. Trousdale 1 Oct. 1971 42 p refs
(Contract F04701-71-C-0172)
(AD-732856; TR-0172(2220-10)-1; SAMSO-TR-71-229) Avail: NTIS CSCL 20/14

Predictions and measurements of microwave breakdown in air are compared for a conical reentry vehicle model with an overall length of approximately one wavelength. The vehicle is excited by means of a circumferential gap to form an asymmetric dipole with roll-symmetric radiation. Measurements performed in an evacuable chamber show breakdown occurring at either the nose tip or the feed gap, or simultaneously in both regions, depending upon the gas pressure. The electric fields are computed as functions of distance radially from the nose tip and normally from the feed gap by the use of moment methods. The breakdown calculation is based on a variational technique that can accommodate CW or pulsed breakdown and can handle nonuniformities in both gas properties and electric fields. Breakdown behavior is calculated at the nose tip and at the feed gap. Theory and experiment are shown to agree within the estimated accuracy of the experiment. Author (GRA)

N72-17128# Goodyear Aerospace Corp., Litchfield Park, Ariz.
BASE PLANT CORRELATOR Interim Report, 8 Jan. - 8 Jun. 1971
David C. Robinson, R. K. Peterson, D. J. Nims, E. J. Little, and J. C. Cratty 8 Sep. 1971 132 p
(Contract DAAK02-71-C-0113)
(AD-732870; GERA-1737; ETL-CR-71-15) Avail: NTIS CSCL 17/9

The Base Plant Correlator is the component of the All-Weather Topographic Mapping System (AWTMS) which converts radar signal films into radar imagery. This interim report presents the studies which Goodyear Aerospace Corporation conducted during the design and study phase (Phase I) of the correlator project which demonstrate that the Phase I equipment designs will meet or exceed the performance requirements set forth by the U.S. Army Engineer Topographic Laboratories (USAETL) in Contract Purchase Description (DAAK02-71-C-0113).
Author (GRA)

N72-17129# White Sands Missile Range, N.Mex. Telemetry Working Group.
TEST METHODS FOR TELEMETRY SYSTEMS AND SUBSYSTEMS
Mar. 1971 158 p refs
(AD-732474; RRC-118-71) Avail: NTIS CSCL 09/6

The document defines standard test methods for telemetry ground stations and the subsystems thereof. Utilization of the methods as described will enable the exchange of system and subsystem test results which are derived and expressed in a common manner. In addition the performance characteristics will also be valuable as an aid in preventive maintenance and readiness evaluation. It is recommended that these methods be used as standards for determining Telemetry System Performance.
Author (GRA)

N72-17130# Sensory Systems Lab., Tucson, Ariz.
CONTROL AND PERFORMANCE MONITORING OF THE MILITARY WORKING DOG Final Report, 1 Feb. 1970 - 31 Jul. 1971
Howard A. Baldwin 1 Nov. 1971 16 p refs
(Grant AF-AFOSR-1897-70; AF Proj. 9777)
(AD-732942; FOSR-71-2936TR) Avail: NTIS CSCL 09/6

The report summarizes the activity of an 18-month exploratory attempt to develop a telemetry technique to monitor alerting responses in military dogs, and to transmit and record the resultant physiological data. The program also attempted to evaluate the feasibility of controlling behavior by telemetric means. Two techniques for monitoring altering responses at distances to one mile were investigated heart rate changes and skin temperature changes. Technical feasibility of the experimental technique under field conditions was demonstrated.
Author (GRA)

N72-17131# Finnish Academy of Technical Sciences, Helsinki.
A CHANNEL STATE FEEDBACK COMMUNICATION SYSTEM
Viljo Hentinew 1971 44 p refs
(PB-202780; APS-EI-26) Avail: NTIS CSCL 17B

A feedback scheme for fading channels is described. In this channel state feedback (CSFB) scheme, the instantaneous value of the channel state is observed, and the observation is used to control the signal energy transmitted for efficient use of good channel conditions. Fading in the forward channel is assumed to be slow and nonselective to make it possible to measure the channel state accurately and simply, and to communicate this estimate to the transmitter. Performance of a certain class of CSFB systems is analyzed, assuming perfect channel estimates and signals constrained in mean energy and bandwidth. It was shown that the CSFB system is approximately equivalent to a four-fold diversity system over Rayleigh fading channels.
Author (GRA)

N72-17132# Illinois Univ., Urbana. Dept. of Civil Engineering.
GEOMETRIC ANALYSIS OF THE RBV TELEVISION SYSTEM
Kam W. Wong, Eugene V. Gamble, and Robert E. Riggins Jul. 1971 60 p refs
(Contract DI-14-08-0001-12631)
(PB-203705; UILU-ENG-71-2017; Rept-33) Avail: NTIS CSCL 17B

The geometric distortion characteristics and calibration problems of the return-beam vidicon television systems which will be flown on the Earth Resource Technology Satellites are studied. The overhall objectives are: (1) to establish the magnitude, pattern and stability of geometric distortions in the RBV system; (2) to devise procedures and data reduction methods for the accurate calibration of the system's internal geometry; and (3) to provide accurate distortion and calibration data for detailed analysis of the potential mapping accuracy of the RBV imageries.
Author (GRA)

N72-17133# Sachs/Freeman Associates, Inc., Hyattsville, Md.
IDENTIFICATION OF INFORMATION AND ASSOCIATED ANALYTICAL TECHNIQUES FOR THE SOLUTION OF FREQUENCY MANAGEMENT PROBLEMS. VOLUME 3: SELECTED TOPICS
Dec. 1970 101 p refs
(Contract OEP-SE-70-101)
(PB-202687) Avail: NTIS CSCL 20N

The use of large scale files and automated analytical techniqeus accommodates the situation that occurs when needed data is missing. This general problem and a series of procedures and data tables are presented for some of the common omissions encountered in the frequency management context. An approach to the development of additional missing data rules is also discussed. Author (GRA)

N72-17134# Sachs/Freeman Associates, Inc., Hyattsville, Md.
IDENTIFICATION OF INFORMATION AND ASSOCIATED ANALYTICAL TECHNIQUES FOR THE SOLUTION OF FREQUENCY MANAGEMENT PROBLEMS. VOLUME 4: MODEL AND DATA BASE SUMMARIES
Feb. 1971 199 p refs
(Contract OEP-SE-70-101)
(PB-202688) Avail: NTIS CSCL 20N

Data sources and mathematical models considered useful in the analysis of national frequency management problems are presented. The items summarized were already developed and are believed to be adaptable to the OTP applications. The extent of needed modifications will, in many cases, be dictated by the degree of compatibility between the old and new data processing systems. Author (GRA)

N72-17135# Stanford Research Inst., Menlo Park, Calif.
A SPECTRUM MEASUREMENT/MONITORING CAPABILITY FOR THE FEDERAL GOVERNMENT Final Report
G. H. Hagn, S. Fralick, H. Shaver, and G. Barker May 1971 306 p refs
(Contract OEP-SE-70-102)
(PB-203062) Avail: NTIS HC $6.00/MF $0.95 CSCL 17B

Several alternatives are defined for an initial spectrum monitoring capability for government spectrum management. Both general and specific capability requirements are identified, alternative system configurations are outlined, and the benefits and costs discussed. Author (GRA)

N72-17892*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
REDUCTION OF NEAR-IN SIDELOBES USING PHASE REVERSAL APERTURE RINGS
W. F. Williams *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 34-42 ref (See N72-17887 08-30)
Avail: NTIS CSCL 17B

N72-17895*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
BIAS AND SPREAD IN EXTREME VALUE THEORY MEASUREMENTS OF PROBABILITY OF ERROR
J. G. Smith *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 58-68 refs (See N72-17887 08-30)
Avail: NTIS CSCL 17B

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N72-17136*+ Lockheed Electronics Co., Houston, Tex. Engineering Data Systems Dept.
BIOMEDICAL COMPUTING FACILITY INTERFACE DESIGN PLAN
R. D. Puckett Nov. 1971 56 p refs
(Contract NAS9-12200; Proj. 7005)
(NASA-CR-115360) Avail: NTIS CSCL 09B

The results are presented of a design study performed to establish overall system interface requirements for the Biomedical Laboratories Division's Sigma-3 computer system. Emphasis has been placed upon the definition of an overall implementation plan and associated schedule to meet both near-term and long-range requirements within the constraints at available resources. Author

N72-17137*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EFFICIENT PARALLEL ALGORITHM FOR THE SOLUTION OF A TRIDIAGONAL LINEAR SYSTEM OF EQUATIONS
Harold S. Stone (Stanford Univ.) Dec. 1971 22 p refs Author was NASA/Stanford ASEE Summer Fellow, 1971
(NASA-TM-X-62103) Avail: NTIS CSCL 09B

Tridiagonal linear systems of equations are solved on conventional serial machines in a time proportional to N, where N is the number of equations. The conventional algorithms do not lend themselves directly to parallel computations on computers of the ILLIAC IV class, in the sense that they appear to be inherently serial. An efficient parallel algorithm is presented in which computation time grows as log sub 2 N. The algorithm is based on recursive doubling solutions of linear recurrence relations, and can be used to solve recurrence relations of all orders. Author

N72-17138# Joint Publications Research Service, Washington, D.C.
AUTOMATED CONTROL AND DATA-PROCESSING SYSTEMS IN INDUSTRY AND SCIENTIFIC RESEARCH
27 Jan. 1972 16 p ref Transl. into ENGLISH from Ekon. i Organizatsiya Prom. Proizv. (Novosibirsk, USSR), no. 2, 1971 p 66-73, 84-91
(JPRS-55047) Avail: NTIS

Papers are presented on computerized control systems in Soviet industries and computerized data processing systems for management of Soviet scientific-engineering research institutes. For individual titles, see N72-17139 through N72-17140.

N72-17139# Joint Publications Research Service, Washington, D.C.
EXPERIENCE IN CREATING AUTOMATED CONTROL SYSTEMS AT INDUSTRIAL ENTERPRISES
L. A. Timoshchuk, B. P. Komin, and Ye. G. Yakovenko *In its* Automated Control and Data-Processing Systems in Ind. and Sci. Res. 27 Jan. 1972 p 1-8 ref (See N72-17138 08-08)
Avail: NTIS

Examples of computerized control at various industrial plants are briefly described. Most of the automation in the machine building industry is at plants with 2000 to 5000 workers and is primarily in planning and administrative operations. Computers are utilized by the coal industry as a whole and in the production-economic activities, as they are also by the chemical industry. Automated control is used mainly in the technological processes by the ferrous metallurgical industry. The use of computers in the food industry is characterized by the inclusion of trade and transport in the operative planning and control problems, and their use by several commercial enterprises is illustrated. N.E.N.

N72-17140# Joint Publications Research Service, Washington, D.C.
ORGANIZATION OF AUTOMATED DATA PROCESSING SYSTEMS FOR MANAGEMENT OF SCIENTIFIC RESEARCH INSTITUTES AND DESIGN OFFICES
S. T. Mitin *In its* Automated Control and Data-Processing Systems in Ind. and Sci. Res. 27 Jan. 1972 p 9-15 (See N72-17138 08-08)
Avail: NTIS

The various steps of using computerized data processing systems in scientific-engineering research institutes are described. All-purpose computers are used for gathering and processing data, and keypunch machines are the primary method of preprocessing the data for computer input. Details are given on the actual gathering and preparation of data, the processing and analysis of data, and the decision making. In the research institutes, the data processing system has two areas: the technical area which provides the solution to problem of simulation and in which experience has been accumulated, and the economic area oriented toward solution of organization or administrative control problems and which is new for the institutes. The individual steps in the processing system are discussed, along with the equipment, programming, and management planning. N.E.N.

N72-17141*# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
A PROGRAM FOR IDENTIFICATION OF LINEAR SYSTEMS
June Buell, Robert Kalaba, Enrique Ruspini (Calif. Univ., Los Angeles), and Andrew Yakush Dec. 1971 23 p refs
(Grant NGR-05-007-195; Contract F44620-70-C-0017; Grant GM-16197-04)
(NASA-CR-125573; TR-71-46) Avail: NTIS CSCL 09B

A program has been written for the identification of parameters in certain linear systems. These systems appear in biomedical problems, particularly in compartmental models of pharmacokinetics. The method presented here assumes that some of the state variables are regularly modified by jump conditions. This simulates administration of drugs following some prescribed drug regime. Parameters are identified by a least-square fit of the linear differential system to a set of experimental observations. The method is especially suited when the interval of observation of the system is very long. Author

N72-17142# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INFORMATION PROCESSING MODELS AND COMPUTER AIDS FOR HUMAN PERFORMANCE. TASK 1: SECOND LANGUAGE LEARNING Final Report
Daniel N. Kalikow 30 Jun. 1971 58 p refs See also Task 2, AD-732232
(Contract F44620-67-C-0033; ARPA Order 890)
(AD-732231; BBN-2185; AFOSR-71-2789TR) Avail: NTIS CSCL 05/9

Two experiments testing the effectiveness of the Automated Pronunciation Instructor (API) were carried out with Spanish-speaking students attempting to learn English. Experiment I tested the computer-generated display of the student's tongue position during stressed vowels. New experimental procedures for evaluating the extent of pronunciation changes were developed and applied. Experiment II tested the effectiveness of the additional two displays. Highly significant training effects were obtained for all three displays, despite the presence of variability in the data. The report concludes with a general discussion of proposed changes to future versions of the API system.
Author (GRA)

N72-17143# Los Alamos Scientific Lab., N.Mex.
COMPUTATIONAL CONSIDERATIONS IN DIGITAL IMAGE ENHANCEMENT
B. R. Hunt 1971 7 p refs Presented at Conf. on Two-Dimensional Digital Signal Processing, Columbia, Mo., 6 Oct. 1971 Sponsored by AEC
(LA-DC-12840; Conf-711006-1) Avail: NTIS

Some of the practical problems encountered in translating the theory of image enhancement to working and efficient computer programs are discussed. The problems of implementing digital filtering of images, and problems in data management and manipulation of the large matrices that represent digitized pictures are examined. Image enhancement techniques can be divided into two categories. Point techniques operate on a single digitized image point. Neighborhood or local techniques act upon several points in the neighborhood of a given point of an image. Mathematical models of imagery processing are presented.
Author

N72-17144# Illinois Univ., Urbana. Dept. of Computer Science.
SPEECH DISPLAY SIMULATION SYSTEM FOR A COMPARATIVE STUDY OF SOME VISUAL SPEECH DISPLAYS
Bernard J. Nordmann, Jr. Aug. 1971 226 p refs
(Contracts AT(11-1)-2118; DAAB07-67-C-0199)
(COO-2118-0018; UIUCDCS-R-71-470) Avail: NTIS

A detailed description of a speech display simulation system is given which has been programmed for the CDC 1604 computer system. This simulator is written as part of an investigation into the relative effectiveness of various types of speech display. Its primary goal is to be as flexible as possible as far as the generation of various types of speech displays is concerned. The speech display simulation is divided into five main areas: the common data base, the command processor, the data handling routines, the speech display routines, and the various subprocessing routines. Author

N72-17145# Johns Hopkins Univ., Baltimore, Md.
MODELLING GENERALIZED PARALLEL COMPUTER SYSTEMS
R. Regis May 1971 22 p refs
(NYO-4209-14) Avail: NTIS

A class of organizations is considered that are characterized, informally, by independent asynchronously operating units capable of simultaneously processing independent (but related) parts of the same program. In other words, assuming that the problem has been partitioned in a set of tasks which can be performed by the processing units (the notion of task is therefore closely related to the processing units), the communications or interactions between these tasks and their influence on the performance of the system is developed. Author

N72-17146# Illinois Univ., Urbana. Dept. of Computer Science.
COMPARATIVE STUDY OF SOME VISUAL SPEECH DISPLAYS Ph.D. Thesis
Bernard J. Nordmann, Jr. 10 Sep. 1971 115 p refs
(Contracts AT(11-1)-2118; AT(11-1)-1018; DAAB07-67-C-0199)
(COO-2118-24; UIUCDCS-R-71-479) Avail: NTIS

A computer speech display simulation system was developed which is capable of generating a wide variety of speech displays from a recorded speech input. After conducting literature search to determine the types of schemes used to display speech sounds, a basic interactive display system was programmed using a CDC 1604 computer graphics facility. The system was designed to be open-ended and currently can produce photographs of a variety of display types. The system as it stands now cannot operate in real time due to the slowness of the CDC 1604. The simulation system was used to produce examples of several different types of displays. These displays were used in a series of preliminary tests designed to develop techniques for comparing the effectiveness of various types of displays. Several corrections and refinements to the testing methods are discussed. Author

N72-17147# Stanford Univ., Calif. Dept. of Computer Science.
REASONING BY ANALOG WITH APPLICATIONS TO HEURISTIC PROBLEM SOLVING: A CASE STUDY
Robert Elliot Kling Aug. 1971 202 p refs
(Contract ARPA SD-183)
(AD-732457; STAN-71-CS-216) Avail: NTIS CSCL 06/4

An information-processing approach to reasoning by analog is developed that promises to increase the efficiency of heuristic deductive problem-solving systems. When a deductive problem-solving system accesses a large set of axioms more than sufficient to solve a particular problem, it will often create many irrelevent deductions that are derived from the unnecessary axioms. These irrelevent deductions may be quite numerous and saturate the memory of the problem solver before it solves the problem. At the current state of the art, the most complex problems solved by automatic procedures require less than two dozen axioms to solve. A data base twice this size is sufficient to render any but the simplest problem unsolvable. In general, there is no decision procedure which can be used to restrict a data base to a set of necessary axioms. Here, any analogy with some previously solved problem and a new unsolved problem is used to restrict the data base to a small set of appropriate axioms.
Author (GRA)

N72-17148# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INFORMATION PROCESSING MODELS AND COMPUTER AIDS FOR HUMAN PERFORMANCE. TASK 2: HUMAN-COMPUTER INTERACTION MODELS Semiannual Technical

Report, 1 Jan. - 30 Jun. 1971
Mario C. Grignetti, Duncan C. Miller, Raymond S. Nickerson, and Richard W. Pew 30 Jun. 1971 104 p refs
(Contract F44620-71-C-0065; ARPA Order 890)
(AD-732913; BBN-2190; AFOSR-71-2845TR; SATR-1) Avail: NTIS CSCL 09/2

A measuring system was implemented to obtain the statistical parameters necessary to specify a queueing theory model of the dynamic behavior of a state-of-the-art time-shared computer system, and present results on the statistics of usage of one such computer system. A methodology is presented for the performance of experiments involving human users and for the interpretation of their results. It is expected that these results will yield predictive models for the overall efficiency of the users-computer system under various circumstances.
Author (GRA)

N72-17149# Washington Univ., St. Louis, Mo. Control Systems Science and Engineering.
CONTROL, GUIDANCE, AND INFORMATION FUNDAMENTALS OF AEROSPACE Progress Report, 1 Sep. 1970 - 30 Aug. 1971
John Zaborszky 20 Aug. 1971 21 p refs
(Contract F44620-69-C-0116; AF Proj. 9558; Proj. Themis)
(AD-732952; AFOSR-71-2943TR) Avail: NTIS CSCL 09/4

The report gives a summary of results achieved during 1970-71 in the areas, among others, of filter theory, singular control of discrete dynamical systems, and in controllability and observability problems of nonlinear and bilinear systems involving the use of algebraic methods, particularly Lie algebras.
Author (GRA)

N72-17150# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
SEMICOHERENT DETECTION AGAINST A SPOOFING OPPONENT
Gerald Walter Lank Jun. 1971 171 p refs
(Grant DA-ARO(D)-31-124-70-G51)
(AD-732898; USCEE-408; AROD-7198-28-RT) Avail: NTIS CSCL 09/4

Many problems arise in radar and sonar applications which can be regarded as problems in detection theory or parameter estimation. Such problems have aspects of game theory associated with them when an intelligent opponent is assumed. This study concerns itself with the detection problem of radar and sonar where one is trying to distinguish between white noise and a short pulse signal imbedded in the white noise. The Doppler frequency shift of the signal is assumed unknown. It is required to distinguish between the desired pulsed signal and an unwanted one when an intelligent opponent is present who can control the Doppler. The unwanted signal return may be encountered, for example, from the combined return from birds or insects in the case of radar or fish in the case of sonar. Often an estimate of Doppler can be used to distinguish targets of this type from a target one wishes to track. If the target one wishes to track is controlled by an intelligent opponent who can choose Doppler in some randomized or nonrandomized manner, e.g., by controlling the aspect angle with respect to the observer, then the development of best detection criteria requires the application of game theory. Against an intelligent opponent, only randomized decisions may be optimum. This is not the case in the normal radar or sonar detection theory problem. Author (GRA)

N72-17151# HRB-Singer, Inc., State College, Pa.
DIGITAL PROCESSING OF IR SCANNER VIDEO Summary Progress Report
Clifford P. Bastuscheck 15 Nov. 1971 47 p
(Contract N00014-71-C-0296; ONR Proj. 414)
(AD-732799; Rept-4567-R-1) Avail: NTIS CSCL 17/5

Infrared line scan video signals were digitized and used in computer processing to determine whether activity changes in the imaged area could be detected. Statistical parameters of the distribution of signal amplitudes within a specific target area were calculated for several types of cultural features, including simulation of activity changes. The experiments showed the feasibility of detecting changes in activity levels using such statistical processes. Author (GRA)

N72-17652*# Massachusetts Univ., Amherst.
CARPET PLOT DATA FORMAT
Joseph M. Byrne *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 392-396 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 09B

N72-17701*# McClellan AFB, Calif.
GE(LI) DATA REDUCTION USING SMALL COMPUTERS
W. E. McDermott *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 744-746 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 09B

N72-17707*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
A MONTE CARLO PHOTOCURRENT/PHOTOEMISSION COMPUTER PROGRAM
W. L. Chadsey and C. Ragona *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 786-791 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 09B

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N72-17152* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH INTENSITY RADIANT ENERGY PULSE SOURCE HAVING MEANS FOR OPENING SHUTTER WHEN LIGHT FLUX HAS REACHED A DESIRED LEVEL Patent
Larry D. Russell, inventor (to NASA) Issued 7 Sep. 1971 6 p Filed 18 Jun. 1970 Supersedes N70-35438 (08 - 19, p 3515)
(NASA-Case-ARC-10178-1; US-Patent-3,603,798; US-Patent-Appl-SN-47443; US-Patent-Class-250-211J) Avail: US Patent Office CSCL 09E

A high intensity radiant energy pulse source is provided which requires no external cooling. The radiant energy source is located at one focal point of an ellipsoidal reflector and a shutter is positioned in the region of the other focal point. Monitoring means are provided for opening the shutter as soon as a predetermined flux level is reached. Additional means control the duration of time the shutter is open.
Official Gazette of the U.S. Patent Office

N72-17153* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TELEMETRY ACTUATED SWITCH Patent
Robert D. Lee, inventor (to NASA) Issued 7 Sep. 1971 7 p Filed 23 Dec. 1969 Supersedes N70-22305 (08 - 09, p 1614)
(NASA-Case-ARC-10105; US-Patent-3,603,946; US-Patent-Appl-SN-887698; US-Patent-Class-340-177; US-Patent-Class-325-492; US-Patent-Class-128-2.1A; US-Patent-Class-307-252F; US-Patent-Class-307-252J) Avail: US Patent Office CSCL 09E

A silicon-controlled rectifier (SCR) provides either a high-impedance or a low-impedance electrical path between, for example, a power source and an instrument. While being

switched from its high impedance to its low-impedance state in response to a first control signal, this SCR is momentarily short-circuited by a transistor which is responsive to both the first control signal and a second control signal. During the momentary short-circuiting, an initial surge of current through a capacitor supplies enough current to the SCR to hold this SCR in its low impedance state. Decay of this current surge with the charging of the capacitor allows this SCR to be switched from its low-impedance to its high-impedance state by again momentarily short-circuiting its anode-to-cathode circuit in response to the second control signal.

Official Gazette of the U.S. Patent Office

N72-17154* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

CURRENT DEPENDENT FILTER INDUCTANCE Patent

Sherwood Thaler, inventor (to NASA) Issued 7 Sep. 1971 6 p Filed 31 Dec. 1969 Supersedes N70-22207 (08 - 09, p 1614)
(NASA-Case-ERC-10139; US-Patent-3,603,864;
US-Patent-Appl-SN-889555; US-Patent-Class-321-10;
US-Patent-Class-336-178) Avail: US Patent Office CSCL 09A

A current dependent variable inductance is described which has a winding and flux coupled magnetic core portion with cross-sectional areas that vary between maximum and minimum values in planes perpendicular to the flux path. Current flow of greater than a given magnitude in the winding causes saturation of the minimum core area and generation of fringing flux in an adjacent auxiliary airgap. The lengths of the fringing flux lines and accordingly of the auxiliary airgap vary directly with the saturation current in the winding. Thus, the value of inductance provided by the winding varies inversely with that current.

Official Gazette of the U.S. Patent Office

N72-17155* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

HIGH VOLTAGE TRANSISTOR AMPLIFIER WITH CONSTANT CURRENT LOAD Patent

John E. Guisinger and George W. Lewicki, inventors (to NASA) Issued 7 Sep. 1971 7 p Filed 10 Oct. 1969 Supersedes N70-35680 (08 - 19, p 3516) Sponsored by NASA
(NASA-Case-NPO-11023; US-Patent-3,603,892;
US-Patent-Appl-SN-865274; US-Patent-Class-330-18;
US-Patent-Class-330-40) Avail: US Patent Office CSCL 09E

An amplifying circuit is described in which a constant current source is used as the collector load for an output amplifying transistor to provide high gain voltage amplification. The amplifying circuit has an high output impedance operable from a high dc supply voltage. The constant current source comprises a number of cascade connected transistors, having their base bias fixed by either diodes or voltage cells. The number of cascade-connected transistors may be varied to accommodate any supply voltage level, while insuring that each load transistor operates below its avalanche breakdown range.

Official Gazette of the U.S. Patent Office

N72-17156* General Precision, Inc., Sunnyvale, Calif.

BROADBAND VIDEO PROCESS WITH VERY HIGH INPUT IMPEDANCE Patent

James W. Wood, inventor (to NASA) Issued 28 Sep. 1971 5 p Field 24 Jun. 1968 Sponsored by NASA
(NASA-Case-NPO-10199; US-Patent-3,609,230;
US-Patent-Appl-SN-739391; US-Patent-Class-178-7.1;
US-Patent-Class-330-11; US-Patent-Class-330-35) Avail: US Patent Office CSCL 09E

A broadband video processor is disclosed. It includes a very-high-input impedance stage which incorporates a field effect transistor. The processor is relatively immune to ambient noise. Also, the high impedance enables the use of a small input capacitor which accounts for fast dc restoring.

Official Gazette of the U.S. Patent Office

N72-17157* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

REFERENCE VOLTAGE SWITCHING UNIT Patent

Edgar S. Davis, inventor (to NASA) Issued 28 Sep. 1971 6 p Filed 23 Mar. 1970 Supersedes N70-34692 (08 - 18, p 3327) Sponsored by NASA
(NASA-Case-NPO-11253; US-Patent-3,609,387;
US-Patent-Appl-SN-21906; US-Patent-Class-307-81;
US-Patent-Class-307-223; US-Patent-Class-307-227;
US-Patent-Class-328-186) Avail: US Patent Office CSCL 09E

A reference voltage-switching unit comprising a dual dc voltage power supply is described which provides +v dc and -v dc voltages across three of its output terminals, one of which is assumed to be at ground. The three terminals are connected to two unit output terminals through a switching unit which includes a voltage divider and three sets of SPDT contacts. The positions of the three sets of contacts are controlled as a function of the binary states of three stages of a three-stage ring counter. As the counter advanced through its eight-state cycle, the positions of the three sets of contacts vary so that the voltage across the unit ouput terminals follows a cyclically recirculating pattern. Official Gazette of the U.S. Patent Office

N72-17158*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF 22 MeV PROTONS ON SINGLE JUNCTION AND SILICON CONTROLLED RECTIFIERS

Marvin E. Beatty, III Washington Feb. 1972 31 p refs
(NASA-TN-D-6631; L7981) Avail: NTIS CSCL 09E

The effects of 22-MeV protons on various types of silicon single junction and silicon controlled rectifiers were investigated. The results show that low-leakage devices and silicon controlled rectifiers are the most susceptable to radiation damage. There are also differences noted between single junction rectifiers of the same type made by different manufacturers, which emphasizes the need for better selection of devices used in spacecraft.

Author

N72-17159*# National Research Corp., Cambridge, Mass.

DEVELOPMENT OF REVERSE BIASED p-n JUNCTION ELECTRON EMISSION Final Report

P. Fowler and E. C. Muly [1971] 58 p refs
(Contract NAS1-8223-3)
(NASA-CR-111985) Avail: NTIS CSCL 09A

A cold cathode emitter of hot electrons for use as a source of electrons in vacuum gauges and mass spectrometers was developed using standard Norton electroluminescent silicon carbide p-n diodes operated under reverse bias conditions. Continued development including variations in the geometry of these emitters was carried out such that emitters with an emission efficiency (emitted current/junction current) as high as 3 x 10-0.00001 were obtained. Pulse measurements of the diode characteristics were made and showed that higher efficiency can be attained under pulse conditions probably due to the resulting lower temperatures resulting from such operation.

Author

N72-17160# Sandia Labs., Albuquerque, N.Mex.

OPERATIONAL AMPLIFIER MODELS FOR COMPUTER AIDED CIRCUIT ANALYSIS

David N. Harstad Oct. 1971 40 p refs Sponsored by AEC
(SC-RR-71-0628) Avail: NTIS

Several operational amplifier models are examined and discussed. They range from a very simple ideal model with four parameters (three elements) to a SCEPTRE model with seventeen elements. From the evaluation, it is concluded that: (1) if correct parameter values are available, the more complex models give more accurate circuit analysis results; (2) the large number of elements present little difficulty if the circuit analysis program has model storage capabilities; (3) for programs where model storage is not available, the simpler models are easy to input and sufficient in many analysis; and (4) if several programs and models are available, the user should use the simplest tool that produces the desired results. D.L.G.

N72-17161# Thermo Electron Corp., Waltham, Mass.
THERMIONIC PERFORMANCE OF CVD TUNGSTEN EMITTERS WITH NIOBIUM AND MOLYBDENUM COLLECTORS
D. Lieb and F. Rufeh May 1971 78 p refs
(Contract AT(30-1)-4125)
(TEE-4125-5; TE-4137-134-71) Avail: NTIS

Two chloride vapor-deposited W emitters were installed in variable spacing converters with Nb and Mo collectors. Thermionic performance data were collected in the form of current density-output voltage curves with cesium families and cesium optimized envelopes for various spacings and temperatures. The performance was compared with that of other converters having (110) and (100) W emitters. The effects of rebuilding one converter and of collector temperature on performance were studied. NSA

N72-17162# Hanford Engineering Development Lab., Richland, Wash.
TGO, A LINEAR PROGRAMMING MODEL FOR OPTIMIZING A POWER TRANSMISSION GRID
R. P. Omberg Jul. 1971 90 p refs
(Contract AT(45-1)-2170)
(HEDL-TME-71-108) Avail: NTIS

A machine program has been written to optimize the design of a high voltage transmission grid between a set of supply and demand points of various sizes. The program is based on the Simplex optimization technique of linear programming and attempts to minimize the number of megawatt-miles in the network. The input data for the program are a set of demand and supply points, their respective latitudes and longitudes, and their respective power requirement or surplus in megawatts. The output from the program is an optimized distribution grid, specifically a set of power lines of different capacities connecting various supply and demand points, and also the total annual cost of this grid in $/year. Author

N72-17163# Lyon Univ. (France). Inst. de Physioque Nucleaire.
EXPERIMENTAL BEHAVIOR OF BIPOLAR TRANSISTORS SUBJECTED TO INTENSE PULSES OF IONIZING RADIATION AND THE RESULTING ANOMALIES Ph.D. Thesis
Roger Genre Jun. 1971 89 p refs In FRENCH
(LYCEN-7127) Avail: AEC Depository Libraries

Photocurrents, and in particular anomalous photocurrents, induced in semiconductor devices by radiation pulses were studied to determine a one-to-one relation between the phenomena observed and a physical process correlated to the semiconductor structure. The general phenomena are reviewed. It is assumed that anomalous photocurrents are always associated with negative resistance regions in the I(V) characteristics of the semiconductor. This hypothesis was verified experimentally. Three mechanisms by which anomalous photocurrents are generated are considered: emitter-base junction breakdown, avalanche injection, and secondary thermal breakdown. A method of simulating gamma pulses using 1-MeV proton pulses is described. NSA

N72-17164# Kernforschungszentrum, Karlsruhe (West Germany). Labor fuer Elektronik und Messtechnik.
CAMAC: HIGH-VOLTAGE MODULE TYPE LEM-52/15.1
W. Heep and W. Stiefel Apr. 1971 32 p refs In GERMAN; ENGLISH summary
(NP-19004) Avail: AEC Depository Libraries

A computer controlled high voltage power supply in the CAMAC system is described. The output voltages can be varied in steps of 0.5 V from 0 to 1000 V by means of stepping motors driving potentiometers with ten turns. The stepping motor control accepts the number of steps to be performed via the dataway and controls the execution. The control unit of the module contains two CAMAC units. A prototype of this module has been working for a few months. Author (NSA)

N72-17165# Westinghouse Research Labs., Pittsburgh, Pa.
GEISHA SEMICONDUCTOR RELIABILITY STUDIES: A PORTION OF CHAIR-GEISHA Semiannual Technical Report, 1 Feb. - 31 Jul. 1971
John R. Szedon and Karl K. Yu 8 Jan. 1971 27 p
(Contract N00014-70-C-0230; NR Proj. 252-002; RF Proj. 23-372-101)
(AD-732460; Rept-71-9F6-EBAMP-R2; SATR-2) Avail: NTIS CSCL 09/1

High dose rate electron radiation studies were performed on GEISHA target diodes to total accumulated dose levels of 1.2 coulomb/sq cm. Comparative studies were made on target diodes passivated with (1) thermal oxide (as control), (2) phosphorus glass over thermal oxide, and (3) silicon nitride over phosphorus glass/thermal oxide. All three types of diodes show initial blocking voltage (BV) degradation, followed by various degrees of BV recovery for continued radiation of all but the control diodes. The silicon nitride passivated diodes show better radiation resistance than the other two systems in that the recovery was faster and that the value of BV after the 1.2 coul/sq cm dose level was equal to or better than the pre-radiation value. New GEISHA diodes were fabricated with a diffused guard junction around the main junction. The BV values of such structures were about 50 volts higher than the ones without the guard junction. For better radiation resistance, experiments were conducted to fabricate a metallic shield over the diode contact periphery. Development of technology for the fabrication of string diode targets was initiated using a metal handle approach. Mo-Au, Ti-Au, and Ni-Au metallization systems were examined with Mo-Au giving the best results.

Author (GRA)

N72-17166# Duke Univ., Durham, N.C. Adaptive Signal Detection Lab.
ADAPTIVE OPTIMUM ARRAY DETECTORS Summary Report, 1970-1971
Marshall A. Gallop, Jr. May 1971 124 p refs
(Contract N00014-70-A-0251-0001)
(AD-732573; TR-7) Avail: NTIS CSCL 09/1

The purpose of this research is to further the theory of signal detectability as applied to systems employing an array of antennas. The specific approach is to make use of optimal space-time likelihood ratio processing for the detection of signals which have varying degrees of uncertainty associated with them. An important aspect of this approach is that no attempt is made to use traditional beam-forming techniques. Optimal array detector design is developed by extending to array antenna systems several problems previously worked for single antenna systems. The first class of problems treated are those which involve detection of a signal of known spatial location. Included in this class are the problems of signal known exactly and signal known except for energy and/or phase. A further and more important extension of optimum array detection is the formulation of the problem of detection of signals of unknown spatial location. Here the target location is considered to be an unknown signal parameter. There is no attempt at beam-forming.

Author (GRA)

N72-17167# Hughes Research Labs., Malibu, Calif.
ELECTRON PHYSICS RESEARCH Final Report, 1 Jul. 1970 - 31 Jun. 1971
K. J. Russell and R. E. Lundgren Oct. 1971 175 p refs
(Contract DAAB07-70-C-0232; DA Proj. 1H6-62705-A-055)
(AD-732940; ECOM-0232-F) Avail: NTIS CSCL 09/1

The purpose of the investigation was to consider new principles and device concepts based on the EBIRD (electron beam ionization of semiconductor devices) operating principle, and to study those principles and device concepts which appeared to have the best potential of achieving successful operation. The ultimate goal was to evolve novel EBIRD devices which might demonstrate advantages over existing devices for use in advanced radar, communications, and ECM systems, especially at frequencies above 1 GHz. The devices and concepts which were analytically investigated for this purpose

were: (1) an EBIRD distributed amplifier which employs a microstrip semiconductor target, (2) large transit-angle (about 3pi) operation of EBIRD targets, (3) an EBIRD class-C oscillator, (4) a device incorporating both EBIRD and avalanche diode operating principles, and (5) possible combinations of EBIRD and LSA (Limited Spacecharge Accumulation) bulk effect principles. Performance estimates, design information, and comparisons with other devices are given, for most of the novel devices considered. Author (GRA)

N72-17168# National Electronics, Inc., Geneva, Ill. Semiconductor Div.
REGENERATIVE GATE TURN-ON THYRISTOR DESIGN WITH VERY FAST TURN-OFF Final Report
D. I. Gray Oct. 1971 89 p refs
(Contract DAAK02-70-C-0472)
(AD-732904) Avail: NTIS CSCL 09/1

An attempt was made to fabricate fast turn-off complementary SCR's using both anode sweep-out and sweep-out from the upper base region of the device. The sweep-out principle was found ineffective for clearing excess charge from the wide center base of the complementary SCR. Evidence is presented to show that excessive carrier trapping is present in the devices fabricated, which also lengthens the device turn-off time. The results show that the complementary structure has inherently good turn-on characteristics, but it also exhibits remarkably poor turn-off characteristics. The authors also encountered problems obtaining the designed blocking voltage. The authors were only able to obtain blocking voltages of about one-third (1/3) of our design goals. The most likely reason that the authors failed to achieve good voltage on the test group of devices was due to tramp impurity contamination and to an ineffective final gettering diffusion. Author (GRA)

N72-17169# Bell Telephone Labs., Inc., Murray Hill, N.J.
MANUFACTURING PROCESS FOR CERAMIC ENCAPSULATED JUNCTION FIELD EFFECT TRANSISTORS (JFETS) AND STATISTICAL EVALUATION OF JFET HEADER DIELECTRIC MATERIALS
H. E. Kern, J. M. McKenzie (Sandia Labs., Albuquerque), and J. H. McQuaid (Calif. Univ., Livermore. Lawrence Radiation Lab.) 1971 11 p refs Presented at Nucl. Sci. Symp., San Francisco, 3 Nov. 1971
(SC-DC-714220; Conf-711111-1) Avail: NTIS

A batch (about 350) of ceramic junction field effect transistors (JFET's) was prepared under standard transistor production conditions. Processing details are reported as well as statistical analyses of electrical measurements obtained on a sample taken from these ceramic JFET's and of glass-and epoxy-encapsulated JFET's containing the same chip type. It was confirmed that ceramic JFET's exhibit the lowest noise levels under all test conditions. Lossy dielectric material in the JFET header is one of the principal sources of noise originating in the input stage of charge-sensitive preamplifiers. Author

N72-17170# Finnish Academy of Technical Sciences, Helsinki.
ON THE PHASE STABILITY OF PARAMETRIC AMPLIFIERS
P. Somervuo and Y. Sirkeinen 1971 26 p refs
(PB-202781; APS-EI-27) Avail: NTIS CSCL 09E

The phase behavior of a parametric amplifier is studied when small variations in pumping or varactor biasing occur. Formulas for the phase instability caused by adjacent signals on the amplifier band are also derived. Experimental results obtained in measurements and with the aid of a computer using a more accurate equivalent circuit of the amplifier are also given.
Author (GRA)

N72-17893*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
DEVELOPMENT OF A 20-W SOLID-STATE S-BAND POWER AMPLIFIER
A. G. vanderCapellen *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 43-48 (See N72-17887 08-30)
Avail: NTIS CSCL 09E

N72-17896*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
ON THE SELECTION OF AN OPTIMUM DESIGN POINT FOR PHASE-COHERENT RECEIVERS EMPLOYING BAND-PASS LIMITERS
M. K. Simon *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 69-77 refs (See N72-17887 08-30)
Avail: NTIS CSCL 09C

10 ELECTRONICS

Includes circuit theory, and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N72-17171* Stanford Univ., Palo Alto, Calif.
RC NETWORKS AND AMPLIFIERS EMPLOYING THE SAME Patent
William J. Kerwin and Lawrence P. Huelsman, inventors (to NASA) Issued 28 Sep. 1971 11 p Filed 17 Apr. 1970 Sponsored by NASA Continuation-in-part of abandoned US Patent Appl. SN-624611, Filed 20 Mar. 1967
(NASA-Case-XAC-05462-2; US-Patent-3,609,567; US-Patent-Appl-SN-28235; US-Patent-Class-328-167; US-Patent-Class-307-295; US-Patent-Class-330-176; US-Patent-Class-330-109; US-Patent-Class-333-70CR) Avail: US Patent Office CSCL 09C

A feedback network interconnects the output of the voltage amplifier with the passive RC network. By regulating the value of the load resistor and the value of the load capacitor jointly or severally, the location of a pair of complex conjugate poles produced by the active filter can be adjusted separately and independently from the zeros. In addition, the regulation of the gain of the dc voltage or operational amplifier or the changing of the feedback voltage of the dc voltage or operational amplifier adjusts independently the location of the pair of complex conjugate poles relative to the zeros. When a plurality of active filter circuits are connected in cascade, a frequency-selective amplifier is formed with the dc voltage or operational amplifiers serving additionally as isolation devices between successive active filter circuits. It was observed that each active filter circuit produces real frequency zeros of transmission at any desired frequency independently of the location of complex poles with respect to the zeros. Official Gazette of the U.S. Patent Office

N72-17172* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACTIVE RC NETWORKS Patent
William J. Kerwin, inventor (to NASA) Issued 14 Sep. 1971 9 p Filed 14 Sep. 1971 Continuation-in-part of abandoned US Patent Appl. SN-714295, filed 19 Mar. 1968
(NASA-Case-ARC-10020; US-Patent-3,605,032; US-Patent-Appl-SN-31885; US-Patent-Class-330-107; US-Patent-Class-330-26; US-Patent-Class-330-31; US-Patent-Class-330-94; US-Patent-Class-330-109) Avail: US Patent Office CSCL 09C

An active RC network is described, which is formed by a voltage amplifier, a passive RC input circuit for the amplifier (including a distributed RC element), and provision for positive feedback from the amplifier output to the circuit input. In one version, a lumped capacitor is connected in shunt with the voltage amplifier, whereby a pole of the network transfer function can be located at any desired position farther from the origin than a zero of the function. Another version includes a lumped resistor, for position location closer to the origin than the zero. Other versions provide for the distributed element to be advantageously divided into a number of sections.
Official Gazette of the U.S. Patent Office

N72-17173* North American Aviation, Inc., Canoga Park, Calif.
HYDROGEN FIRE DETECTION SYSTEM WITH LOGIC CIRCUIT TO ANALYZE THE SPECTRUM OF TEMPORAL VARIATIONS OF THE OPTICAL SPECTRUM Patent
Robert L. Proffit, inventor (to NASA) Issued 28 Sep. 1971 5 p Filed 2 Feb. 1970 Sponsored by NASA
(NASA-Case-MFS-13130; US-Patent-3,609,364; US-Patent-Appl-SN-7868; US-Patent-Class-250-83-3UV; US-Patent-Class-250-209; US-Patent-Class-340-228.2) Avail: US Patent Office CSCL 09C

A hydrogen fire detector for use on a high altitude rocket is described. A hydrogen fire is detected by the ultraviolet radiation of the hot oxygen-hydrogen radical produced by hydrogen combustion, while the device selectively filters out ultraviolet radiation from other sources. The detection system senses both temporal variation and steady state radiation. Discrimination against engine exhaust plume radiation is accomplished by monitoring temporal variation. Solar discrimination is accomplished by a two-color technique whereby radiation is detected by two photomultiplier tubes, one filtered to accept visible radiation and the other filtered to accept ultraviolet radiation. The photomultiplier tubes control input to logic that produces an output signal only when a hydrogen fire is viewed.
Official Gazette of the U.S. Patent Office

N72-17174*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHASE-LOCK DEMODULATION OF A PM SIGNAL CONTAMINATED WITH INCIDENTAL AM
George B. Robinson Washington Feb. 1972 58 p refs
(NASA-TR-R-377; G-1032) Avail: NTIS CSCL 17B

Signals from phase-modulated satellite transmitters usually exhibit some degree of incidental amplitude modulation. The effects of incidental AM are analyzed when this type of signal is demodulated by a phase-lock receiver which does not employ a limiter preceding the loop phase detector. The presence of incidental AM causes a reduction in the receiver output signal-to-noise ratio. The tolerable level of AM decreases in proportion to the phase modulation index Beta. For a square-wave modulating signal, a 1 db reduction results at the receiver PM channel output when Beta = 1 radian and the percentage of AM = 23, Beta = 1.2 radians and the percentage of AM = 16, or Beta = 1.5 radians and the percentage of AM = 4. Although only the PM channel of the receiver is used ordinarily, utilizing both the AM and PM channel by summing offers an improvement in S/N relative to the S/N ratio of the PM channel if the percentage of incidental AM is greater than fifteen.
Author

N72-17175*# Arizona Univ., Tucson. Engineering Experiment Station.
DESIGN OF NON-INTERACTING MULTIVARIABLE DISCRETE TIME SYSTEMS Semiannual Report
Bajarang L. Agrawal, Theodore L. Williams, and Donald G. Schultz Jan. 1972 109 p refs
(Grant NGL-03-002-006)
(NASA-CR-125574) Avail: NTIS CSCL 09C

The theory of decoupling a multivariable system with the help of state variable feedback is applied to discrete time systems. The system differential equations in the continuous time domain are converted to a discrete time representation. A discrete time controller is designed to control the overall input to the system such that a specified desired decoupled output response is obtained. The decoupled system behaves as a set of single-input, single-output systems and state variable techniques can be easily applied to control each output individually. Control is achieved by periodically sampling the inputs and all the states and feeding them back through a controller. For linear time invariant systems the control is time invariant. The basic theory of decoupling involves feeding back all the states twice, first to decouple the system and then to achieve a desired response. The states of the system are computed with the help of a state estimator which calculates all the present states of the system so that on-line control can be applied to real time systems. The theory is applied to a model of a nuclear rocket engine. Author

N72-17176*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF A VOLTS-PER-HERTZ REFERENCE CIRCUIT FOR THE ISOTOPE BRAYTON SYSTEM
Heinz L. Wimmer Washington Feb. 1972 20 p refs
(NASA-TM-X-2502; E-6626) Avail: NTIS CSCL 09C

In Brayton-cycle power systems, the speed decreases rapidly with overload. If the voltage decreases linearly with speed (frequency), the power decreases as the square of the voltage. This makes the system more tolerant of overloads. A volts-per-hertz reference circuit, consisting of a volts-per-hertz sensor and a voltage limiter, was designed and fabricated. This reference circuit was incorporated in an existing voltage regulator to control a turbine-driven alternator. Test results show that the control does function to reduce voltage at speeds below the rated speed and that it performed successfully during transients.
Author

N72-17177# Sandia Labs., Albuquerque, N.Mex.
MEASUREMENT PROGRAM AND CALIBRATION STANDARDS FOR MICROSTRIP MEASUREMENTS WITH AN AUTOMATIC NETWORK ANALYZER
Volker Reich 21 Sep. 1971 20 p refs Transl. into ENGLISH from NTZ-Nachrtech. Z. (Brunswick), v. 24, no. 5, 1971 p 255-259
(SC-T-71-3067) Avail: NTIS

To eliminate error, calibration standards and a measurement program were developed for a computer-controlled network analyzer. Thus the effects of conductors and junctions to the test specimen could be numerically corrected after completion of a calibration measurement.
Author

N72-17178# Sandia Labs., Albuquerque, N.Mex.
GENERALIZED THEORY OF IMPEDANCE LOADED MULTICONDUCTOR TRANSMISSION LINES IN AN INCIDENT FIELD
Charles W. Harrison, Jr. Jul. 1971 25 p refs Sponsored by AEC
(SC-R-71-3303) Avail: NTIS

A general theory is advanced for determining the currents in the load impedances of an N-conductor isolated transmission line excited by an electromagnetic field with the electric vector directed parallel to the wires. The number of impedance loads in the circuit is 2N. An impedance is connected in series with each conductor at its ends. At each end of the transmission line the impedances emanate from a common node. There is no requirement that the conductors be of the same radius, be equally spaced, or lie in a common plane; however, their axes must be parallel. Evidently the cross section of the line must be sufficiently small in terms of the wavelength that transmission line theory applies. Numerical values for the load currents in a three-conductor model are given. Scattering from end-loaded multiconductor transmission lines is considered. It is shown that for configurations lacking geometrical symmetry such problems become arduous if not solved by computer.
Author

N72-17179# Sandia Labs., Albuquerque, N.Mex.
CURRENT SHAPING TECHNIQUES FOR HIGH-VOLTAGE CAPACITOR BANKS
William K. Tucker Aug. 1971 19 p refs Sponsored by AEC
(SC-DR-71-0463) Avail: NTIS

Two methods for shaping current pulses are described. The first method is used for producing a sine wave pulse and the second method for more general shaping. The first method, called series foil pulse shaping, uses a thin aluminum foil in series with the capacitor bank current. This foil is designed to explode at the peak of the current pulse, thus placing a high resistance in series with the capacitor. The second method, called foil chop shaping, also uses a thin aluminum foil in series with the capacitor current. However, directly underneath this foil is a thin sheet of dielectric resting on the return conductor which is perforated with a series of small holes. The high pressure

generated by the exploding foil ruptures the dielectric, placing a short across the capacitor bank. Author

N72-17180# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems
SHAPER OF PULSES FROM THE SEMICONDUCTOR RADIATION DETECTORS WITH RC AND RLC CHAINS
Slavko Ivanov Ormandzhiev 1971 16 p refs In RUSSIAN
(JINR-P6-6052) Avail: AEC Depository Libraries

A system consisting of RC and RLC networks and used for shaping of impulses from semiconductor devices was studied. Formulas are derived for calculating signal/noise ratio and for determining the resolution time of the shaping system. A possibility is considered for compensating for the effect of differentiation of the preamplifier from the shaper in output pulse. Some recommendations for constructing the amplifier are given, together with a schematic for the amplifier. Author (NSA)

N72-17181# Johns Hopkins Univ., Baltimore, Md.
MATHEMATICAL MODEL OF ASSIGNMENT FOR REALIZING MODULAR SEQUENTIAL LOGIC NETWORKS
Svetlana P. Kartashev Aug. 1971 50 p refs
(NYO-4209-15; Rept-15) Avail: NTIS

The problem of coding automata by specifying logic networks which can be synthesized from several of the same type of integrated units is investigated for large integrated circuit technology. The problem is solved only for input-free (autonomous) automata. The approach of trying all possible assignments is absent, which may mean that the algorithms can be applied to computer design. Author

N72-17182# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS, SEPTEMBER 1971
Sep. 1971 46 p refs
(PB-203392) Avail: NTIS CSCL 14B

Contents: Experimental study at audio frequencies of a half-wave rectifying circuit with a theoretical efficiency of 100%; lithium fluoride glow-peak growth due to annealing; acoustics; chemistry; electrons; metallurgy; nuclear and atomic physics; published reports; papers by NRL staff members; and patents.
Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N72-17183* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WIND TUNNEL TEST SECTION Patent
John W. Davis and Olen E. Hill, inventors (to NASA) Issued 7 Sep. 1971 6 p Filed 31 Dec. 1969 Supersedes N70-35676 (08 - 19, p 3523)
(NASA-Case-MFS-20509; US-Patent-3,602,920; US-Patent-Appl-SN-889557; US-Patent-Class-73-147) Avail: US Patent Office CSCL 14B

A test section for use in a short duration wind tunnel capable of simulating very-high Reynolds numbers over the transonic speed range is described. An exterior circular tube contains a perforated concentrically disposed sleeve assembly forming an annular flow plenum between the exterior tube and the sleeve assembly. The main flow stream through the wind tunnel is through the sleeve assembly with sucking off occurring through the holes in the walls of the sleeve assembly into the plenum. Flow into the plenum is adjustable to obtain the desired main stream flow velocity and the optimum cancellation of shock and expansion waves produced when the gas flow strikes the test model in the test section.
Official Gazette of the U.S. Patent Office

N72-17184*# Radiation, Inc., Melbourne, Fla. Systems Engineering Dept.
ERTS DIRECT READOUT GROUND STATION STUDY Final Report
Dec. 1971 241 p refs
(Contract NAS5-21622)
(NASA-CR-122343; Rept-7640-72-001) Avail: NTIS CSCL 14B

A system configuration which provides for a wide variety of user requirements is described. Two distinct user types are considered and optimized configurations are provided. Independent satellite transmission systems allow simultaneous signal transmission to Regional Collection Centers via a high data rate channel and to local users who require near real time consumption of lower rate data. In order to maximize the ultimate utility of this study effort, a parametric system description is given such that in essence a shopping list is provided. To achieve these results, it was necessary to consider all technical disciplines associated with high resolution satellite imaging systems including signal processing, modulation and coding, recording, and display techniques. A total systems study was performed. Author

N72-17185# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
VACUUM MAGNETIC FIELDS OF LINEAR STELLARATORS WITH SHAPED COILS
G. Lehner and F. Pohl Jul. 1971 14 p refs
(IPP-1/119) Avail: AEC Depository Libraries

Mathematical approximations are developed for the stellarators, and two types of expansions are given. The fast one is valid for sufficiently slender coils and the second one for coils with a sufficiently small helical deviation. Some numerical results are described and compared with the results of the approximation. Author (NSA)

N72-17186# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
PRIMARY-FREQUENCY STANDARDS IN THE Y-12 PHYSICAL AND ELECTRICAL STANDARDS LABORATORY
R. F. Wolny 20 Sep. 1971 13 p refs
(Contract W-7405-eng-26)
(Y-IA-92) Avail: NTIS

A 60-kHz signal, controlled by a cesium beam oscillator, at the National Bureau of Standards in Colorado, is used as a time interval and frequency standard. The frequency of an ultrastable quartz oscillator is compared with the 60-kHz signal, and the oscillator drift rate is monitored. Present drift rate of the oscillator approaches 2 x 10 to the -11th power per day and accuracy, based on the NBS signal, is + or - 2 parts in 10 to the 11th power. A frequency synthesizer provides outputs from 0.01 Hz to 50 MHz. The drift rate of this instrument is a few parts in 10 to the 9th power per day. It is possible to measure root mean square fractional frequency deviation of the synthesizer using a general purpose counter and the ultrastable quartz oscillator. Values approximating 2 x 10 to the -7th power were obtained over a limited range from 5 to 100 Hz. Because phase shift errors are more acute at these lower frequencies, the data should represent worst-case conditions. Author

N72-17187# Danish Atomic Energy Commission, Risoe.
MULTI-PURPOSE IRRADIATION PLANT AND THE QUALITY CONTROL OF RADIATION STERILIZATION OF MEDICAL EQUIPMENT
Ebbe A. Christensen (Statens Seruminstitut, Copenhagen) and Niels W. Holm Jun. 1971 20 p refs Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep.

1971
(A/Conf-49/P-804; Conf-710901-432) Avail: AEC Depository Libraries

Commonly occurring activities with a service irradiator may comprise a wide variety of processes, such as sterilization of medical supplies, germ reduction in pharmaceutical raw materials or intermediate products, sprout inhibition in potatoes and onions, and radiation chemical processing. The design requirements of future multipurpose irradiation facilities, particularly those whose services include sterilization of medical supplies are discussed. It is concluded that multipurpose irradiation plants are feasible. Plant design suggestions for a Co-60 source facility and an electron accelerator facility are presented. NSA

N72-17188# Daresbury Nuclear Physics Lab. (England).
[ELECTRON SYCHROTRON OPERATION AND EXPERIMENTS] Annual Report
1970 135 p refs
(Np-18909) Avail: AEC Depository Libraries

Details are given of work in experimental and theoretical physics, work at the synchrotron radiation facility, in computing and electronics at the electron synchrotron (operation and development), in machine physics, in engineering, in health and safety, administration, and publications. The NINA experimental program is discussed. Work was also started on the synchrotron radiation facility, which is intended to exploit synchrotron radiation in the range 1 to 2000A, produced copiously in NINA. NSA

N72-17189# Oak Ridge National Lab., Tenn.
K-2 CENTRIFUGE FLOW IMPROVEMENT
N. Cho (Oak Ridge Gaseous Diffusion Plant), J. P. Breillatt, J. N. Brantley, and N. G. Anderson 26 Oct. 1971 14 p refs
(Contract W-7405-eng-26)
(K-L-6280) Avail: NTIS

The K-series centrifuges were initially developed for isolation of influenza virus. The centrifuge has since expanded beyond vaccine production into the field of serum and subcellular particle fractionation. The improved K-II, referred to as K-XII, is capable of 20-l/hr flow at 4 psid at 35,000 rpm. This is a significant improvement over the K-II. In particular, this improvement is achieved without having to change the rotor dimension, drive, damper, seal, etc. The reduction in speed-dependent back pressure is achieved by reducing vortex, diode, and turbulence effects present in the K-II rotor. The schematic of the K-XII centrifuge assembly is shown. Author

N72-17190# Joint Inst. for Nuclear Research, Dubna (USSR).
SOME PROBLEMS IN THE CONSTRUCTION OF A COLLECTIVE ACCELERATOR (KOLTSETRON)
Yu. Derendyaev, I. N. Ivanov, M. L. Iovnovich, A. K. Kaminskii, V. I. Mironov, V. A. Preizendorf, N. B. Rubin, and V. P. Sarantsev 1971 16 p refs In RUSSIAN
(JINR-P9-6003) Avail: AEC Depository Libraries

The formation of a magnetic field for focusing and accelerating the electron-ion ring in a collective accelerator is studied. Tolerance requirements are obtained for the magnetic field of the primary section of the accelerating system. The effects of ion accumulation on the formation of the ring are examined. Design problems in connection with the required electron ring for the collective accelerator are considered in the case where the magnetic field is constant with respect to time. Author (NSA)

N72-17191# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ACCELERATION OF THE Xe IONS IN THE JINR CYCLOTRONS
I. A. Shelaev, V. S. Alfeev, V. A. Zager, S. I. Kozlov, I. V. Kolesov, A. F. Linev, V. N. Melnikov, R. Ts. Oganesyan, Yu. Ts. Oganesyan, and V. A. Chugreev 1971 15 p refs In RUSSIAN
(JINR-P9-6062) Avail: AEC Depository Libraries

An accelerating system is described consisting of 2 cyclotrons 2 and 3 meters in diameter with the help of which Xe ion beams of about 7 MeV/N will be obtained. Author (NSA)

N72-17192# Stanford Linear Accelerator Center, Calif.
DESCRIPTION AND PHYSICS PROGRAM OF THE PROPOSED RECIRCULATING LINEAR ACCELERATOR (RLA)
Sep. 1971 79 p refs
(Contract AT(04-3)-515)
(SLAC-139) Avail: NTIS

A method of approximately doubling the energy of the SLAC Accelerator by recirculation of the beam and reinjection into the machine for a second pass is described. The recirculator could also be used for high duty cycle (up to 6%) experiments at the recirculating energy by storing the beam and extracting about 1% of the electrons per revolution. Recirculation will initially occur at an energy of 17.5 GeV. Beam losses of approximately 125 MeV due to synchrotron radiation would be compensated by 2 sectors (666 ft) of standard accelerator sections operating at the accelerator frequency (2856 MHz). These sectors will be pulsed at a repetition rate of 43,500 pulses per second corresponding to the recirculating period of about 23 microseconds. The beam will be stored for 2.8 milliseconds (approximately 122 revolutions around the 6900 meter storage path); this is the time interval between the normal pulses of the accelerator. Using this method, the energy of the SLAC accelerator could be increased initially to about 42.5 GeV. The recirculator is designed to permit later increase.
Author (NSA)

N72-17193# European Organization for Nuclear Research, Geneva (Switzerland).
DAMPING OF THE EFFECT OF THE INCREASE OF BEAM DIMENSIONS DUE TO THE INFLUENCE ON NONLINEAR RESONANCES AT THE IHEP ACCELERATOR
V. I. Gridasov, K. P. Myznikov, and V. N. Chepegin May 1971 12 p refs Transl. into ENGLISH from Gos. Kom. po Ispolz. At. Energii SSSR, Serpukhov. Inst. Fiz. Vysokikh Energii, report IFVE-SKU-70-90
(CERN-Trans-71-30; IFVE-SKU-70-90) Avail: AEC Depository Libraries

The increased dimensions of the extracted proton beam from the Serpukhov Synchrotron were studied. The dependence of the beam dimensions on the value of the magnetic field of the accelerator, the dependence of the frequencies of the betatron oscillations on the radial position of the beam, and the dependence of the beam dimensions on the radial position of the beam during the flat top of the magnetic cycle are presented graphically. It is concluded that the main reason for the increase of the beam dimensions is the effect of nonlinear resonances, and correction procedures are outlined. NSA

N72-17194# European Organization for Nuclear Research, Geneva (Switzerland).
MEASUREMENT OF THE FREQUENCIES OF BETATRON OSCILLATIONS AT THE IHEP ACCELERATOR AT MEDIUM AND HIGH ENERGIES
K. F. Gertsev, V. I. Gridasov, A. A. Kuzmin, K. P. Myznikov, and G. F. Senatorov May 1971 16 p refs Transl. into ENGLISH from Russian Report IFVE-SKU-70-86 of Gos. Kom. po Ispol'z. At. Energii SSSR
(CERN-Trans-71-31; IFVE-SKU-70-86) Avail: AEC Depository Libraries

The frequencies of the betatron oscillations were measured by two different methods in medium and high fields. The first method used the dependence of the relative displacement of the closed orbit, when there is local perturbation of the magnetic field, on the frequency of the betatron oscillations. The second method was based on the resonant excitation of coherent betatron oscillations. The measuring equipment is described and results are presented. NSA

N72-17195# General Motors Corp., Santa Barbara, Calif. Delco Electronics Div.
RUSSIAN APPROACH TO TERRAIN-VEHICLE SYSTEMS: AN EXERCISE IN PRAGMATISM AND CONTINUITY Final Report
M. G. Bekker Aug. 1971 393 p
(Contract DAJC19-70-C-0019)
(AD-730341; TR-71-30) Avail: NTIS HC $6.00/MF $0.95 CSCL 13/6

The Russian approach to terrain-vehicle systems is compared to U.S. research in this field. The persistent and dynamic continuity of the Russian approach is demonstrated. Author

N72-17196# Naval Ordnance Lab., White Oak, Md.
AN AERODYNAMIC CENTER FOR ORDANCE RESEARCH AND DEVELOPMENT Final Report
R. E. Wilson and S. M. Hastings 18 May 1971 33 p refs Presented at the NATO Defense Res. Group Seminar on Gen. Probl. Relating to Aerodyn. Testing Facilities, St. Louis, France, 4-7 May 1971
(NOL Proj. 603-4300)
(AD-732544; NOLTR-71-87) Avail: NTIS CSCL 14/2

An aerodynamic center for conducting ordnance research and development is described. It is assumed that subsonic and transonic facilities are available at some other installation or installations. The center is, therefore, specialized in that only high-speed facilities are provided. After outlining facility specifications, automatic data handling and instrumentation requirements are reviewed. Comments on costs cover initial investment, operating, and maintenance and repair. Finally, the staff which should be associated with the Center is discussed, and the makeup of the professional staff is examined. GRA

N72-17197# Harry Diamond Labs., Washington, D.C.
DESIGN AND TESTING OF A CURRENT AND VOLTAGE MONITOR FOR HIFX
Franklin J. Sazama and Alexander G. Stewart Aug. 1971 67 p refs
(HDL Proj. 26900)
(AD-732433; HDL-TR-1558) Avail: NTIS CSCL 20/7

A kiloampere, pulse-current monitor and a megavolt, pulse-voltage monitor was built to characterize the performance of field-emission diodes on HDL's pulse electron accelerator (HIFX). The monitors were calibrated under kilovolt-pulse conditions, using a specially developed coaxial circuit, and tested by making time-synchronized current and voltage measurements on a hemisphere-plane diode. The measured diode current and voltage pulses are consistent with waveform and bremsstrahlung output expectations for the accelerator. The initial anode-cathode gap impedances obtained from these measurements are in reasonable agreement with the gap impedance calculated from the Langmuir-Child three-halves power law for space charge limited diodes. These findings indicate that the monitors are capable of measuring pulsed current and voltage waveforms with sufficient amplitude and timing accuracy to be useful in future field-emission diode studies. The monitors can provide a better understanding of those diode parameters that control electron energy and bremsstrahlung angular distribution. This understanding should permit the design of pulsed bremsstrahlung diodes that are capable of producing photons and electrons with greater or more desirable energies and spatial distributions.
Author (GRA)

N72-17198# Stanford Univ., Calif. Dept. of Computer Science.
A STUDY OF THE REAL-TIME CONTROL OF A COMPUTER DRIVEN VEHICLE Ph.D. Thesis
Rodney Albert Schmidt, Jr. Aug. 1971 172 p refs
(Contract ARPA SD-183)
(AD-732644; SU-CS-231; SU-AIM-149) Avail: NTIS CSCL 13/6

Vehicle control by the computer analysis of visual images is investigated. The areas of guidance, navigation, and incident avoidance are considered. A television camera is used as the prime source of visual image data. In the guidance system developed for an experimental vehicle, visual data are used to gain information about the vehicle system dynamics, as well as to guide the vehicle. This information is used in real time to improve performance of the non-linear, time-varying vehicle system. A scheme for navigation by pilotage through the recognition of two dimensional scenes is developed. A method is proposed to link this to a computer-modelled map in order to make journeys. Various difficulties in avoiding anamolous incidents in the automatic control of automobiles are discussed, together with suggestions for the application of the study to remote exploration vehicles or industrial automation. Author (GRA)

N72-17199# Naval Air Engineering Center, Philadelphia, Pa. Engineering Dept.
SHIPBOARD OPERATIONAL EVALUATION OF CARRIER LANDING AID STABILIZATION SYSTEM
Wesley F. Davis 18 Oct. 1971 40 p refs
(Contract N00156-69-C-0710)
(AD-732446; NAEC-ENG-7712) Avail: NTIS CSCL 01/5

A prototype Carrier Landing Aid Stabilization System (CLASS) has undergone two shipboard operational evaluations. CLASS operation was compared to the current FLOLS MK6 Mod 1 Stabilization system. Review of the test data reveals CLASS provides significantly improved performance and operational advantages. Author (GRA)

N72-17200# Mitre Corp., McLean, Va.
AIR CUSHION SUPPORT FOR EVACUATED TUBE SYSTEM VEHICLES Final Technical Report
Willard E. Fraize Sep. 1971 22 p refs
(Contract DOT-C-7-35248)
(PB-203569; FRA-RT-72-21) Avail: NTIS CSCL 13F

The practicality of a plenum-type air cushion suspension for evacuated tube system (TVS) vehicles is examined from the standpoint of ideal air cushion/vehicle characteristics (power, mass flow, self-support velocity, cushion temperature), the compressor design, and the compressor efficiency under low pressure operating conditions. For a representative 100,000 lb TVS vehicle, an air cushion suspension is shown to be practical from all standpoints, providing tube pressure is no less than .015 atm, and the cushion gap is of the order of .01 ft. The method of analysis is presented graphically in a manner readily permitting analysis of other TVS configurations. Author (GRA)

N72-17201# Federal Aviation Administration, Washington, D.C.
GROVE CITY AIRPORTS, GROVE CITY, PENNSYLVANIA Final Environmental Impact Statement
1 Oct. 1971 25 p
(PB-203247-F) Avail: NTIS CSCL 01E

The project proposes to acquire land for airport development; to construct runways and taxiways terminal apron and taxiway turnarounds; to construct access road; to install medium intensity lighting system including VASI, stub taxiway lighting and rotating beacon, and lighted wind cone and segmented circle. The proposed development will provide a paved and lighted airport which will enhance the overall economy of the area served and improve the industrial and commercial growth of the community. Author (GRA)

N72-17202# Federal Aviation Administration, Washington, D.C. Airport Service.
SANTA BARBARA MUNICIPAL AIRPORT, SANTA BARBARA, CALIFORNIA: ENVIRONMENTAL IMPACT STATEMENT
7 Oct. 1971 127 p
(PB-201533-F) Avail: NTIS CSCL 01E

The project proposes to construct a portion of a parallel taxiway to serve the main instrument runway at the Municipal Airport. The proposed taxiway improvement is not expected to affect the environment of the surrounding area or hinder the ecological balance of Goleta Slough. Author (GRA)

N72-17203# Air Force Dept., Washington, D.C.
ENVIRONMENTAL STATEMENT FOR 1550TH AIR TRAINING AND TEST WING (MAC), HILL AIR FORCE BASE, UTAH Final Environmental Impact Statement.
2 Nov. 1971 48 p
(PB-198764-F; AF-ES-71-1F) Avail: NTIS CSCL 01E

The effects are considered of the consolidation of all Air Force advanced helicopter training at Hill AFB, Utah. Major training areas will be in Weber, Davis, Salt Lake, Box Elder, and Tooele counties. This new mission will create an approximately 4% increase in average daily air traffic in the Salt Lake Valley, with consequent increase in aircraft engine emissions. There will be some air pollutant emissions from the fire/rescue training area and visible smoke emitted during the training period. There will be minimal impact on water quality. Author (GRA)

N72-17883*# Translation Consultants, Ltd., Arlington, Va.
INVESTIGATIONS OF THE PIVOTS OF THE MERIDIAN CIRCLE OF THE ODESSA ASTRONOMICAL OBSERVATORY
M. Yu. Volyanskaya and A. M. Stafeyev *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 114-118 refs (See N72-17874 08-30)
Avail: NTIS CSCL 14B

N72-17675*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN CONSIDERATIONS AND TEST FACILITIES FOR ACCELERATED RADIATION EFFECTS TESTING
William E. Price, Charles G. Miller, and Richard H. Parker *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 570-576 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

N72-17682*# White Sands Missile Range, N.Mex. Nuclear Weapons Effects Div.
SPACE RADIATION STUDIES AT THE WHITE SANDS MISSILE RANGE FAST BURST REACTOR
A. DeLaPaz *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 618-619 (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

N72-17713*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN CONSIDERATIONS FOR COMBINED RADIATION EFFECTS FACILITIES FOR TWELVE YEAR OUTER PLANET SPACECRAFT VOYAGES
Charles G. Miller *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 844-849 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N72-17204# Aeronautical Research Labs., Melbourne (Australia).
THE METHOD OF THE FALSE TRANSIENT: APPLICATION TO FLUID MECHANICS
G. D. Mallinson and G. DeVahl Davis Apr. 1971 43 p refs
(ARL/SM-331; ISBN-642-97700-3) Avail: NTIS

A method for the numerical solution of coupled nonlinear partial differential equations typical of those describing steady fluid motion is presented. The essence of the method is the replacement of elliptic equations by equations which are parabolic with respect to a time-like variable, through the addition of general transient terms. This is a generalization of techniques used by Chorin, Rushton and Laing and Dorodnicyn to simplify the numerical solution of particular equations. The advantages of the present techniques are evaluated by solving a problem of natural convection using the results of Rubel and Landis for comparison. It is shown that compared with conventional techniques the method is superior in terms of both numerical stability and computational efficiency, facilitating application to a wider range of fluid mechanical phenomena than previously practicable. The recirculating flow induced in a square cavity by a sliding top is also considered. New results are presented for high Reynolds number flow and a comparison is made between solutions obtained using various finite difference approximations to the governing equations. Some observations concerning the accuracy of the approximations are discussed.
Author

N72-17205*# Techtran Corp., Glen Burnie, Md.
RETROSPECT AND THE GOALS OF TURBULENCE RESEARCH
Werner Albring Washington NASA Feb. 1972 12 p refs Transl. into ENGLISH from Wiss. Z. Tech. Univ. Dresden (East Germany), v. 19, no. 4, 1970 p 975-979
(Contract NASw-2037)
(NASA-TT-F-14100) Avail: NTIS CSCL 20D

The high points are reviewed in the development of the field of turbulence analysis, dwelling in particular on the findings of Rayleigh, Prandtl, and Taylor. Rayleigh's studies of the development of vortex fields in viscous fluids are discussed, the importance of Prandtl's work, including his mixing length hypothesis, is noted, and Taylor's contribution to the development of the statistical theory of turbulence is evaluated. Studies concerning the transition from laminar to turbulent flow, performed by Raleigh and Tollmien, are summarized. Author

N72-17206# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PROBLEMS OF MEASUREMENT ON MODEL OF THE THRUST OF A SUPERSONIC AIRCRAFT AFTER-BODY STANDARD NOZZLES
Bernard Masure 1971 16 p refs In FRENCH; ENGLISH summary Presented at the AGARD Meeting on Inlets and Exhaust of Aerospace Propulsion Systems, Sandefjord, Norway, 13-17 Sep. 1971
(ONERA-TP-978) Avail: NTIS

A technique for measuring the thrust of an afterbody in a wind tunnel, through an upstream cyclindrical strut, is described. This measurement permits the correction of global measurements made on complete models with simplified hollow nacelles. Precision was checked by various calibrations, including tests on a standard convergent-divergent nozzle. Checking and analysis of the results for complex configurations, including a primary convergent nozzle, were based on knowledge of flow ratio and thrusts of corresponding sonic nozzles. Data concerning such nozzles are presented for a wide varity of shapes for tests performed within the atmosphere, without external flow. The results are compared with theoretical data. Author

N72-17207*# Boeing Co., Seattle, Wash. Commercial Airplane Group.
FLOW FIELD ANALYSIS OF AIRCRAFT CONFIGURATIONS USING A NUMERICAL SOLUTION TO THE THREE-DIMENSIONAL UNIFIED SUPERSONIC/HYPERSONIC SMALL DISTURBANCE EQUATIONS, PART 1
R. C. Gunness, Jr., C. J. Knight, and E. DSylva Washington NASA Feb. 1972 115 p refs
(Contract NAS1-9562)
(NASA-CR-1926; D6-25124-Pt-1) Avail: NTIS CSCL 20D

The unified small disturbance equations are numerically solved using the well-known Lax-Wendroff finite difference technique. The method allows complete determination of the inviscid flow field and surface properties as long as the flow remains supersonic. Shock waves and other discontinuities are accounted for implicity in the numerical method. This technique was programed for general application to the three-dimensional case. The validity of the method is demonstrated by calculations on cones, axisymmetric bodies, lifting bodies, delta wings, and a conical wing/body combination. Part 1 contains the discussion of problem development and results of the study. Part 2 contains flow charts, subroutine descriptions, and a listing of the computer program. Author

N72-17208*# Boeing Co., Seattle, Wash. Commercial Airplane Group.
FLOW FIELD ANALYSIS OF AIRCRAFT CONFIGURATIONS USING A NUMERICAL SOLUTION TO THE THREE-DIMENSIONAL UNIFIED SUPERSONIC/HYPERSONIC SMALL-DISTURBANCE EQUATIONS, PART 2
E. DSylva Washington NASA Feb. 1972 300 p refs
(Contract NAS1-9562)
(NASA-CR-1927; D6-25124-Pt-2) Avail: NTIS CSCL 20D
For abstract, see N72-17207.

N72-17209*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECT OF INJECTION ANGLE ON THE INTERACTION BETWEEN SONIC SECONDARY JETS AND A SUPERSONIC FREE STREAM
Charles R. McClinton Washington Feb. 1972 34 p refs
(NASA-TN-D-6669; L-8125) Avail: NTIS CSCL 20D
An experimental investigation, as part of a research program on the development of technology for the design of supersonic combustion ramjets, has been conducted to determine the effect of injection angle on the jet penetration, mixing rate, and airstream total-pressure recovery downstream of five laterally spaced sonic hydrogen jets flush mounted on a flat plate. Results of this investigation indicated that at lower injection angles less free-stream momentum loss was required to turn and accelerate the injected gas downstream and, thereby, less flow disturbance and total-pressure loss were produced. In addition, lower injection angles resulted in improved fuel distribution and faster mixing of the injected gas with the free stream. A correlating parameter, developed from considerations of the effective-momentum-flux differences between the injected gas and the free-stream air, predicted greater penetration and faster mixing for the lower injection angles. Author

N72-17210# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
ASYMPTOTIC BEHAVIOR OF THE TWO-STREAM INSTABILITY
D. Biskamp and R. Chodura Jun. 1971 15 p refs
(IPP-6/97) Avail: AEC Depository Libraries
Some theoretical ideas are investigated to better understand the results of numerical simulations of the one-dimensional two-stream instability. The observed relation drift velocity equals electron thermal velocity implies a principle of maximum dissipation. On a microscopic level it is shown that the quasi-linear solution is inconsistent with the velocity equality, and the assumption of an adiabatically growing BGK wave can not explain the observed similarity behavior. It is proposed that the anomalous resistivity be due to an instability of a BGK wave. Speculations on the multi-dimensional case are made in connection with preliminary results of two-dimensional computations.
Author (NSA)

N72-17211# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre D'Etudes Nucleaires.
LINEAR CONVERSION OF WAVES FOR AN OBLIQUE INCIDENCE
M. Fichet 1971 2 p refs In FRENCH; ENGLISH summary Presented at Phys. Conf., Evian, France, 25-29 May 1971
(CEA-CONF-1803; Conf-710527-3) Avail: AEC Depository Libraries
Linear conversion of waves at the upper hybrid resonance for oblique propagation is considered. The conditions for the validity of a fourth-order equation near the resonance are discussed. NSA

N72-17212# Addis Translations International, Woodside, Calif.
APPROXIMATIVE METHOD OF CALCULATING PHYSICAL QUANTITIES BEHIND A SHOCK WAVE FRONT
V. R. Kuropatenko 1970 17 p refs Transl. into ENGLISH from Chislennye Metody Mekh. Sploshnoi Sredy (USSR), V. 1, no. 5, 1970 p 77-83 Sponsored by AEC Prepared for UCRL, Livermore
(UCRL-Trans-10539) Avail: NTIS
The numerical solutions of problems in gas dynamics by inhomogeneous difference methods which isolate strong and weak discontinuities are presented. The solution of a set of equations relating physical parameters on both sides of the shock wave are examined. The convergence of the iteration process for the solution of the flow equations is described. Mathematical models of the pressure relationships are provided.
Author

N72-17213# Scientific Translation Service, Ann Arbor, Mich.
SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR FLOW IN COUNTERCURRENT GAS CENTRIFUGES
M. Lotz 1971 9 p refs Transl. into ENGLISH from " Stroemungsmech-anische Vorgaenge in Grazentrifugen, DFVLR-Kolloqium" p 81-91 Conf. held 14 May 1970, Porz, West Ger.
(K-Trans-61-2; Conf-700557-10) Avail: NTIS
Flow rates in UF6 centrifuges are small compared with centrifuge peripheral speeds. These conditions are such that the Navier-Stokes equation, the energy equation, and the continuity equation can be linearized. A solution to this system of equations is derived which represents an axial countercurrent which is independent of the axial coordinate. The pressure and temperature are represented as having a linear course in axial direction. The temperature is constant across the radius. The solution is compared with solutions obtained by other workers.
NSA

N72-17214# Sandia Labs., Albuquerque, N.Mex.
CONTINUUM THICK SHEATH PROBE STUDIES IN HYPERSONIC IONIZED BOUNDARY LAYERS
K. Touryan (Cornell Aeron. Lab., Inc.) and D. W. Boyer Sep. 1971 24 p refs Presented at Intern. Symp. on Dyn. of Ionized Gases, Tokyo, 13 Sep. 1971
(SC-DC-71-4077; Conf-710921-1) Avail: NTIS
Extensive studies were made of the sheath structure and current collection characteristics of flush-mounted electrostatic probes installed on the dielectric surface of a sharp leading edge flat plate in an ionized hypersonic flow environment. The studies included experimental and numerical investigations of the effect of probe size, geometry, applied voltage, and local hypersonic boundary layer properties on the current-voltage characteristics of the probes. Test conditions were such that the sheath was collisional and often constituted an appreciable part of the boundary layer. Author (NSA)

N72-17215# Princeton Univ., N.J. Dept. of Chemical Engineering.
EFFECTS OF INTERFACIAL TENSION GRADIENTS ON THE MOTION OF DROPS AND BUBBLES
D. A. Saville [1971] 33 p refs Sponsored by AEC
(Grants NSF GJ-34; NSF GU-3157)
(NYO-2807-93) Avail: NTIS
The motion of small drops and bubbles is examined within the context of a theory which takes account of surface tension gradients brought on by composition variations around the

periphery of a drop or bubble. Two situations are examined for large Peclet numbers: an almost-freely-circulating interface and an almost-rigid interface. The theory predicts a fairly rapid transition between these two states as the radius is decreased. Furthermore, the internal circulation patterns are asymmetric with the internal toroidal eddy shifted towards the front of the drop, in agreement with experimental observations. Author

N72-17216# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
MODELING OF TWO PHASE FLOW WITH HEAT TRANSFER
J. A. Boure Aug. 1971 13 p Transl. into ENGLISH from Proceedings of 4th Inter. Heat Transfer Conf. (Versailles), 31 Aug. - 5 Sep. 1970
(LIB/Trans-381) Avail: AEC Depository Libraries

Scaling laws for two-phase flows cannot be developed by the classical methods of dimensional analysis because of the number of parameters to be accounted for. A method for establishing these laws is described. The method is applied to two-phase liquid/vapor flows with heat transfer. For the phenomenon of burnout, the laws are compared with experimental results. It is shown that a satisfactory model may be obtained. Author

N72-17217# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
NORMAL IMPACT OF A FINITE CYLINDRICAL LIQUID JET ON A FLAT RIGID PLANE
Yen C. Huang, F. G. Hammitt, and Wen-Jei Yang Aug. 1971 29 p refs
(Grant NSF GK-730)
(PB-203384; UMICH-03371-9-T) Avail: NTIS CSCL 20D

Particular emphasis is given the unsteady-state portion during the initial process. The governing partial differential equations of compressible flow, neglecting body force, viscosity, and surface tension are solved numerically by a compressible-cell-and-marker solution method. Numerical results are checked by solving the classical one-dimensional water hammer problem. Pressure build-up and lateral flow begin simultaneously with the impact, but the radial expansion of the cylindrical jet near the contact edge is not appreciable during this earliest stage of impact. A zone of negative pressure appears in the upper region of the finite cylindrical jet but there is no bursting out of the back surface. Author (GRA)

N72-17218# Illinois Univ., Urbana. Water Resources Center.
METHODOLOGY FOR SYNTHESIS AND OPTIMIZATION OF DIFFUSION PATTERNS IN FLOW SYSTEMS Final Report, 1 Jul. 1970 - 30 Jun. 1971
W. Hall, C. Maxwell, and Kuo-Cheng Chang Jul. 1971 56 p refs
(OWRR Proj. A-046-Ill)
(PB-204523; UILU-WRC-71-0044; W72-01490) Avail: NTIS CSCL 13B

A generalization of Reichardt's hypothesis for the development of a unified treatment for the synthesis of diffusion patterns for mass, heat, and momentum is discussed. The technique was applied to coplanar and coaxial flows in a study of the effects of initial flux distribution and outlet shape on diffusion patterns, and to shallow submerged outlets. Four simple approximations to the P function, involving only exponential and error functions, were found to represent flux distributions downstream from a circular jet of finite size at all points between the nozzle and infinity. The results may be applied in the study and design of discharge outlets, siphon spillways, hydraulic breakwaters, and diffusion of tracers in streams and penstocks. GRA

N72-17219# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
UNSTEADY FLOW IN TUBES AND TUNNELS Final Report
Forbes T. Brown, Gary Knebel, and Donald Margolis Aug. 1971 327 p refs
(Contract DOT-C-85-65)
(PB-204584; DSR-76107-4FRA-RT-72-22) Avail: NTIS CSCL 20D

A theory is presented for the attenuation and dispersion of small sinusoidal waves superimposed on gross turbulent flow in cylindrical tubes. Three frequency bands are distinguished: a low frequency band in which a constant inertance resistance compliance model applies, a high frequency band in which a time-invariant eddy viscosity model applies, and an intermediate transition band for which no complete theory is given. A quasi-method of characteristics is presented in general and in detail for the case of fluid transients with history-dependent properties such as occur at intermediate and high frequencies. Historic weighting functions were found for laminar flow and several turbulent flows. Results were extended to include the effects of heat transfer in a perfect gas contained by isothermal walls. GRA

N72-17220# ARO, Inc., Arnold Air Force Station, Tenn.
FLOW FIELD MEASUREMENTS OF A JET IN CROSSFLOW WITH A LASER VELOCIMETER Final Report
T. W. Binion, Jr. AEDC Nov. 1971 33 p refs
(Contract F40600-72-C-0003; AF Proj. 8219; ARO Proj. PD0141)
(AD-732841; ARO-PWT-TR-71-159; AEDC-TR-71-192) Avail: NTIS CSCL 20/4

Tests were conducted in a low speed wind tunnel (V/STOL) to measure the velocity field of a jet issuing from a flat plate with crossflow. Velocity components were measured with a dual-scatter laser velocimeter at effective velocity ratios of 0.125 and 0.250. The data yielded velocity vectors along lines normal to the jet centerline in three planes parallel to the plane of symmetry. Indications of the flow field turbulence were also measured. Author (GRA)

N72-17221# Oceanics, Inc., Plainview, N.Y.
THE STABILITY OF A VORTEX PAIR IN THE PRESENCE OF A GROUND PLANE
Nicholas R. Rotta Nov. 1971 48 p refs Revised
(Contract F44620-70-C-0106)
(AD-732473; AFOSR-71-2486TR-Rev; Rept-71-81A) Avail: NTIS CSCL 20/4

The configuration stability of a vortex pair in the presence of a ground plane is examined. First the motion of a vortex in three dimensions is examined by the method of matched asymptotic expansions in which the solution of the Navier-Stokes equations are constructed asymptotically. The dependence of the velocity and stability of the vortex on factors such as the outer (inviscid) flow field and viscosity in the inner (vortical core) region is clearly established. The proximity of the ground plane enters through the outer solution which is matched to the inner, viscosity dependent, solution. The vortex pair in ground effect is shown to be unstable to disturbances of all wavelengths with increasing amplification rate as the ground is approached. Indications are that the present analysis predicts a more stable (less unstable) vortex system than does the inviscid theory. Comparison of the present analysis, in the limit of zero ground effect, with photographs of vortices undergoing a configuration instability is made. The viscosity necessary for agreement is found to be on the order of the eddy viscosity for the turbulent line vortex, indicating the existence of turbulence in the vortex core. Author (GRA)

N72-17222# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
THREE DIMENSIONAL LAMINAR BOUNDARY LAYER OVER BODY OF REVOLUTION AT INCIDENCE. PART 5: FUTHER INVESTIGATION NEAR THE PLANE OF SYMMETRY
Kuo C. Wang Sep. 1971 86 p refs

(Contract F44620-70-C-0085; AF Proj. 9749)
(AD-732919; RIAS-TR-71-14C; AFOSR-71-2714TR) Avail: NTIS CSCL 20/4

The previously investigated three-dimensional boundary layer near the plane of symmetry of an inclined spheroid is extended along three directions: wider range of solutions, explanations to questions left unanswered before, and comparisons with experiments. Extended solutions provide more complete trends for incidences from zero to 90 degrees and for thickness ratios ranging from unity for a sphere to nearly zero for a long inclined cylinder. Among these trends is how the separation changes from one type to another and then back again with increasing incidence. Explanations are given for a number of unconventional features; included here is why the lateral derivative of the cross velocity profile reverses. Agreement with Wilson's recent experiments (designed specifically for partial check of the results obtained earlier) enhances the significance of the investigation undertaken. GRA

N72-17223# Naval Research Lab., Washington, D.C. Plasma Physics Div.

A FLUID TRANSPORT ALGORITHM THAT WORKS

Jay P. Boris Nov. 1971 39 p refs
(NRL Proj. MR-2357)
(AD-732749; NRL-MR-2357) Avail: NTIS CSCL 20/4

The paper describes a class of explicit, Eulerian finite-difference algorithms for solving the continuity equation which are built around a technique called flux correction. These Flux-Corrected Transport Algorithms are of indeterminate order but yield realistic, accurate results. In addition to the mass-conserving property of most conventional algorithms, the FCT algorithms strictly maintain the positivity of actual mass densities so steep gradients and inviscid shocks are handled particularly well. This paper concentrates on a one-dimensional version called SHASTA. Author (GRA)

N72-17224# Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.

AN EVALUATION OF ACOUSTIC TECHNIQUES FOR MEASURING GAS BUBBLE SIZE DISTRIBUTIONS IN CAVITATION RESEARCH Project Report, 1 Oct. 1969 - 30 Dec. 1970

Frank R. Schiebe and John M. Killen May 1971 26 p refs
(Contract N00014-67-A-0113-0014)
(AD-732772; Rept-120) Avail: NTIS CSCL 20/4

The acoustic tone burst attenuation technique for measuring the gas bubble size distribution in water was critically reviewed. The findings indicate how the usefulness of the technique is limited to a bubble volume concentration range between 0.03 and 1.0 parts per million. Resolution between size ranges is probably not obtainable with sufficient accuracy for the purposes intended. GRA

N72-17225# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

EXPERIMENTAL RESULTS OF LAMINAR BOUNDARY LAYER SEPARATION ON A SLENDER CONE AT ANGLE OF ATTACK AT M INFINITY EQUALS 14.2 Final Report

Kenneth F. Stetson Aug. 1971 112 p refs
(AF Proj. 706500)
(AD-732889; ARL-71-0127) Avail: NTIS CSCL 20/4

Wind tunnel experiments with a 5.6 degree half angle cone at M = 14.2 indicated that the three-dimensional separation bubble concept was not the correct flow field model for these data. Based on data consisting of surface pressure measurements, pitot pressure surveys, and surface oil flow patterns, a new model for hypersonic three-dimensional separation is proposed. This model contains symmetrical supersonic helical vortices with an attachment line on the most leeward ray. The vortices are in contact with the surface, at least up to alpha = 18 deg. and there is no subsonic reverse flow or singular points associated with the vortex pattern. Author (GRA)

N72-17226# Institute for Defense Analyses, Arlington, Va. Jason Div.

WAKE COLLAPSE IN A STRATIFIED FLUID: LINEAR TREATMENT

Harold W. Lewis Sep. 1971 16 p
(Contract DAHC15-67-C-0011)
(AD-732784; P-816; IDA/HQ-71-13483) Avail: NTIS CSCL 20/4

The problem of wake collapse in an incompressible, linearly stratified fluid with no boundaries is solved in the linear Boussinesq approximation. Author (GRA)

N72-17227# Defense Documentation Center, Alexandria, Va.

INVISCID FLOW, VOLUME 1 Bibliography Report, Jan. 1967 - Mar. 1971

Nov. 1971 268 p refs
(AD-732900; DDC-TAS-71-47-1) Avail: NTIS CSCL 20/4

This bibliography provides selected references in the subject area of inviscid flow. The citations are based on theoretical, actual, and experimental data and conditions to which inviscid flow concepts can be applied. Corporate author-monitoring agency, subject, title, personal author, contract, and report number indexes are provided. GRA

N72-17228# State Univ. of New York at Buffalo. Fluid Thermal Sciences Lab.

A SURVEY OF VARIATIONAL METHODS IN FLUID DYNAMICS

Chun Hian Lee and Ralph T. Cheng Jan. 1971 40 p refs
(Grant NSF GK-11687)
(PB-202356; FTSL-TR71-2) Avail: NTIS CSCL 20D

A review on the applications of variational techniques to the field of fluid dynamics is presented. Traditionally, the calculus of variations is frequently applied to other fields of dynamics. Due to the Eulerian representation, the application of variational methods to fluid dynamics becomes restrictive. It may be shown that when the Euler system is used in the variational principle for a given fluid flow problem, the analogy to the particle dynamics is lost. Consequently, various approximation techniques are involved which are discussed in the present report.
Author (GRA)

N72-17229# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.

COMPUTER SIMULATION OF HIGH SPEED COLLISION WITH RAINDROP (COMBINED SPHERICAL-CYLINDRICAL SHAPE)

Yen C. Huang, F. G. Hammitt, and Wen-Jei Yang Sep. 1971 36 p refs Submitted for publication
(Grant NSF GK-730)
(PB-203387; UMICH-033710-12-T) Avail: NTIS CSCL 20D

The objective of the paper was to investigate the collision process between a rain drop and a rigid plane. Effort was directed to simulate this impact phenomenon. Results such as the deformation of the simulated rain drop, isobar distribution within the droplet at various instants, pressure distributions on the impact surface and everywhere within the computation domain were recorded by computer. Other variables such as density, velocity and momentum were also found as a function of time. Author (GRA)

N72-17230# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.

IMPACT OF SPHERICAL WATER DROP ON FLAT RIGID SURFACE

Yen C. Huang, F. G. Hammitt, and Wen-Jei Yang Aug. 1971 29 p refs
(Grant NSF GK-730)
(PB-203385; UMICH-033710-10-T) Avail: NTIS CSCL 20D

The impact of a spherical water drop upon a rigid plane is studied. The governing partial differential equations of compressible hydrodynamics neglecting body force, viscosity and

surface tension are solved with a new Compressible-Cell-and-Marker numerical technique. Flow patterns, impact pressures and velocities are found as a function of time. As the liquid boundary is free to deform, compression and rarefaction take place simultaneously after the first instant of impact. However, the net effect of compression is predominating during the early stages of impact, until the radial lateral flow velocity exceeds the impact velocity, then the pressures attenuate. The maximum pressure attained is only about 70% of the waterhammer pressure. This latter point is of considerable importance in estimating damage capability of such impacts. Author (GRA)

N72-17231# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
A NOTE ON SHOCK WAVE VELOCITY IN HIGH-SPEED LIQUID-SOLID IMPACT
Yen C. Huang, F. G. Hammitt, and T. M. Mitchell Sep. 1971 10 p refs Submitted for publication
(Grant NSF GK-730)
(PB-203386; UMICH-033710-11-T) Avail: NTIS CSCL 20D

An improved relationship between shock wave and impact velocities in high speed liquid-solid impact was determined from the fundamental equations of continuity, momentum, and state. Very good agreement was found upon comparison with experimental data for water. Author (GRA)

N72-17232# Naval Ship Research and Development Center, Bethesda, Md.
LAMINAR FLOWS PAST AN INFINITELY THIN DISK
Hans J. Lugt and Samuel Ohring Sep. 1971 33 p refs
(SR Proj. 003-03-01)
(AD-732752; NSRDC-3654) Avail: NTIS CSCL 20/4

Numerical computations of axisymmetric laminar flows past an infinitely thin disk strongly indicate that the solutions of the Navier-Stokes equations are weakly singular at the tip points. This means that vorticity and pressure at the surface of the disk become infinite with the inverse square root of the distance from the tip. Complete numerical instability which was encountered in previous studies is avoided by excluding the tip from the grid system. Computer output is displayed and discussed for Reynolds numbers 70 and 100. GRA

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N72-17233 Illinois Univ., Urbana.
A STUDY OF TRAVELING DISTURBANCES IN THE IONOSPHERE Ph.D. Thesis
David Hamilton Cowling 1970 156 p
Avail: Univ. Microfilms Order No. 70-20942

Recordings made at three spaced stations of relative changes in Faraday rotation of a plane wave transmitted by the ATS 3 satellite through the ionosphere reveal certain short term variations which appear to be sinusoidal. A periodogram analysis of these variations is carried out and speeds and directions of these wave-like disturbances are derived. Because these disturbances appear to be long period infrasonic waves, i.e., gravity waves, a computer program is developed to ray trace waves of this nature from the ground to ionospheric heights. The results are plotted in the form of a series of contour charts. These charts are modified by a time-slipping procedure and in their new form are thought to show preferred directions that a wave-like disturbance should be seen propagating, for different times of the day and for different horizontal propagation speeds. Probable sources of most of these disturbances are determined to be weather or jet stream effects. Finally there is noted some similarity between the general diurnal form of the data analyzed and diurnal directions contained in contour charts.
Dissert. Abstr.

N72-17234 Tennessee Univ., Knoxville.
WAVEFORM AND COMPUTER ANALYSIS OF GEOGRAPHIC PATTERNS RECORDED ON COLOR AND COLOR INFRARED PHOTOGRAPHY FROM AERIAL AND ORBITAL ALTITUDES Ph.D. Thesis
Graydon Lennis Berlin 1970 166 p
Avail: Univ. Microfilms Order No. 70-20295

A black and white television system successfully translated pictorial or iconic forms of color and color infrared photography to the analytic. The instrumentation system enabled a video conversion of land use or land type occurrences to graytone percentages, with a certain range of percentages representing a specific type. Colors were successfully converted to identifiable graytones from photos made at 5,000 feet, 15,000 feet, and from orbital altitudes exceeding 100 miles. With geographic patterns in digital form, a computer program was developed to process the waveform analysis of imagery. An orbital photo of the lower Nile Valley was digitized, and the computer accomplished the following tasks: (1) transformed graytone percentages to letter equivalents, (2) mapped graytone distributions, and (3) estimated the area of each graytone distribution. Additional discussion noted equipment additions that could be incorporated into the television system to more fully automate computer inputs. Dissert Abstr.

N72-17235 *European Space Research Inst., Frascati (Italy).*
MESOSPHERIC MODELS AND RELATED EXPERIMENTS
G. Fiocco, (ed.) Dordrecht, Neth. D. Reidel Publ. Co. 1971 308 p Proc. of the 4th ESRIN-ESLAB Symp., Frascati, Italy, 6-10 Jul. 1970
(LC-70-154737; ISBN-90-277-0200-4) Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

Current experimental work, both field and laboratory, related to mesospheric structure and composition is assessed in the light of theoretical work on atmospheric models and atomic and molecular processes. For individual titles, see N72-17236 through N72-17260.

N72-17236 Institut d'Aeronomie Spatiale de Belgique, Brussels.
AERONOMIC REACTIONS OF HYDROGEN AND OZONE
M. Nicolet *In* ESRIN Mesospheric Models and Related Expts. 1971 p 1-51 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

The photochemical reactions involving hydrogen and ozone in the stratosphere and the mesosphere are reviewed, including the ozone formation and dissociation, and the oxygen, methane, and water vapor photodissociations. Some reactions involving the molecular hydrogen, the hydrogen peroxide, and nitrogen oxides are discussed. ESRO

N72-17237 Oslo Univ. (Norway).
A MERIDIONAL MODEL OF THE OXYGEN-HYDROGEN ATMOSPHERE
Eigil Hesstvedt *In* ESRIN Mesospheric Models and Related Expts. 1971 p 52-64 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

Photochemical models for reactions between oxygen and hydrogen compounds are used for studying the chemical composition of the mesosphere and lower thermosphere. The distribution of the mesospheric and thermospheric components such as atomic oxygen and ozone and others in a meridional plane is analyzed. ESRO

N72-17238 Radio and Space Research Station, Slough (England).
OXYGEN, HYDROGEN AND NITROGEN CONSTITUENTS IN THE MESOSPHERE AND IONIZATION PROCESSES

L. M. Thomas *In* ESRIN Mesospheric Models and Related Expts. 1971 p 65-77 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

The ionization processes operating in the D-region at middle latitudes are discussed, as well as the role played by oxygen, hydrogen, and nitrogen constituents having a controlling influence on the thermal balance of the mesosphere. ESRO

N72-17239 Oxford Univ. (England). Clarendon Lab.
ENERGY CONVERSIONS AND MEAN VERTICAL MOTIONS IN THE HIGH LATITUDE SUMMER MESOSPHERE AND LOWER THERMOSPHERE
Paul J. Crutzen *In* ESRIN Mesospheric Models and Related Expts. 1971 p 78-88 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

A part of the solar energy initially absorbed in the upper atmosphere appears in chemical form (dissociation energy or energy of excited species). The chemical species which carry most of the initially stored energy (e.g. atomic oxygen in the ground state and first electronically excited state) initiate a variety of chemical processes in which many vibrationally and electronically excited species participate. The last stages in the decay of the chemical energy, the relaxation of excited molecular oxygen and nitrogen, and the role played by radiating gases such as carbon dioxide and water vapor are discussed and illustrated by numerical results. ESRO

N72-17240 European Space Research Inst., Frascati (Italy).
PHOTOCHEMISTRY AND THE ESCAPE EFFICIENCY OF TERRESTRIAL HYDROGEN
R. T. Brinkmann (Lunar Sci. Inst.) *In its* Mesospheric Models and Related Expts. 1971 p 89-102 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

The molecular oxygen in the earth's atmosphere is studied including the atomic oxygen production and the water vapor photodissociation. Hydrogen atoms are produced primarily by the photodissociation of the water vapor. Some liberated hydrogen atoms will escape out of the vapor atmosphere, altering the chemical composition of the atmosphere. The escape efficiency of hydrogen atoms is calculated. ESRO

N72-17241 European Space Research Inst., Frascati (Italy).
DYNAMICAL MODELLING OF THE STRATOSPHERE AND MESOSPHERE
R. J. Murgatroyd *In* ESRIN Mesospheric Models and Related Expts. 1971 p 104-121 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

A dynamic model for the stratosphere and mesosphere is described, taking into account the thermal profile, the eddy currents, and mean meridional and vertical motions in the stratosphere and the mesosphere. ESRO

N72-17242 Chicago Univ., Ill. Dept. of Geophysical Sciences.
TIDES AND GRAVITY WAVES IN THE UPPER ATMOSPHERE
Richard S. Lindzen *In* ESRIN Mesospheric Models and Related Expts. 1971 p 122-130 refs Sponsored by Alfred P. Sloan Found. (See N72-17235 08-13)
(Grant NSF GA-1622)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

Atmospheric tides are internal gravity waves modified by the earth's sphericity and rotation for which the periods (integral fractions of a day) and excitations are known. The properties of internal gravity waves are reviewed, as well as their transport properties. ESRO

N72-17243*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE METEOROLOGICAL STRUCTURE OF THE MESOSPHERE INCLUDING SEASONAL AND LATITUDINAL VARIATIONS
J. S. Theon and W. S. Smith *In* ESRIN Mesospheric Models and Related Expts. 1971 p 131-146 refs (See N72-17235 08-13)
(NASA-TM-X-67522) Avail: NTIS; Springer Verlag, New York; D. Reidel, Dordrecht, Neth. CSCL 04A

During 1960, 208 meteorological soundings of the mesosphere were conducted from Ascension Islands (8 deg S), Natal, Brazil (6 deg S), Wallops Islands, Viginia (38 deg N), Churchill, Manitoba (59 deg N), and Barrow, Alaska (71 deg N). The data obtained during these soundings consisting of vertical profiles of temperature, density, and wind are presented and compiled into cross-sections and maps. ESRO

N72-17244 Institut d'Aeronomie Spatiale de Belgique, Brussels.
ULTRAVIOLET SOLAR RADIATION RELATED TO MESOSPHERIC PROCESSES
M. Ackerman *In* ESRIN Mesospheric Models and Related Expts. 1971 p 149-159 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

The solar radiation in the mesospheric processes penetrates with different degrees of attenuation; the two main absorbing species being the molecular oxygen and the ozone. The oxygen, and to a lesser degree ozone, control the mesosphere penetration of solar ultraviolet radiation. To evaluate the number of photons available at different altitudes, absorption cross-sections data on ozone and molecular oxygen are discussed. Polar photon flux, ozone, and oxygen absorption cross-sections are listed for fixed wavelength intervals suitable for photochemical computations. ESRO

N72-17245 Institut d'Aeronomie Spatiale de Belgique, Brussels.
PENETRATION OF SOLAR RADIATION IN THE SCHUMANN-RUNGE BANDS OF MOLECULAR OXYGEN
G. Kockarts *In* ESRIN Mesospheric Models and Related Expts. 1971 p 160-176 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

The Schumann-Runge bands are in the chemosphere where they are situated in the 1750 to 2050 A region and where the solar radiation can penetrate into the earth's atmosphere. The depth of chemospheric penetration of the solar radiation can be determined with data from absorption cross section measurements and the structural determination of the 0-0 to the 13-0 Schumann-Runge bands. ESRO

N72-17246 Oxford Univ. (England). Clarendon Lab.
RELAXATION OF THE 2.7 MICRONS AND 4.3 MICRONS BANDS OF CARBON DIOXIDE
A. P. Williams *In* ESRIN Mesospheric Models and Related Expts. 1971 p 177-187 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

A significant amount of solar radiation is absorbed by the 2.7 and 4.3 microns vibration-rotation bands of carbon dioxide. In the lower regions of the atmosphere, collisional excitation and de-excitation are the dominant processes; the atmosphere is in the state of thermodynamic equilibrium, with the population of excited states governed by a Boltzmann distribution. The radiative deactivation becomes more important in the higher atmosphere. The emitted radiation may be lost from the atmosphere or absorbed in other regions in order to determine the net heating rate. A model is described starting from the Schwarzchild's equation of radiative transfer. ESRO

N72-17247 Environmental Science Services Administration, Boulder, Colo. Aeronomy Lab.
LABORATORY MEASUREMENTS OF D-REGION

ION-MOLECULE REACTIONS
E. E. Ferguson *In* Esrin Mesospheric Models and Related Expts. 1971 p 188-197 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

Laboratory measurement of ion neutral particle reactions using the flowing afterglow technique are reported, discussed, and compared with previous measurements and calculations of direct ionospheric observations. Information on D-region positive and negative ion chemistry is deduced. ESRO

N72-17248 Environmental Science Services Administration, Boulder, Colo.
THE ROLES OF WATER VAPOR AND NITRIC OXIDE IN DETERMINING ELECTRON DENSITIES IN THE D-REGION
George C. Reid *In* ESRIN Mesospheric Models and Related Expts. 1971 p 198-209 refs Partly sponsored by DASA (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

Electron density profiles obtained during ionospheric sounding by rocket-borne mass spectrometer at 60 deg solar zenith angle for different seasons showed a very steep gradient in electron density between 80 and 90 km altitude. This feature is referred to as the ledge in electron density. It was suggested that the ledge in electron density coincided with the sharp change in nature of the dominant positive ion species from NO(+) above the ledge to the water-cluster ion H30(+)H2O below the ledge. The water-cluster ions were shown to have extremely large recombination coefficients of the order of 0.00005 cu cm/sec. These high recombination coefficients are discussed in a qualitative way. Some recent laboratory measurements of recombination coefficients of water-cluster positive ions are used to examine conditions in the neighborhood of 80 km with emphasis on the problem of nitric oxide ions in relation to the water-cluster ions. ESRO

N72-17249 State Univ. of New York, Albany.
DISCUSSION OF THE FORMATION OF MAJOR POSITIVE AND NEGATIVE IONS UP TO THE 50 km LEVEL
Volker A. Mohnen *In* ESRIN Mesospheric Models and Related Expts. 1971 p 210-219 refs (See N72-17235 08-13)
(Contract N00014-69-C-0043)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

The formation of major positive and negative ions at altitudes up to 50 km is discussed, and the major ion species are predicted. It is shown that associative attachment processes and their possible role in ion induced gas-to-particle conversion seem to play a role in stratospheric and mesospheric ion chemistry. ESRO

N72-17250 Birkbeck Coll., London (England).
ELECTRONIC COLLISIONS c24
J. B. Hasted *In* ESRIN Mesospheric Models and Related Expts. 1971 p 220-230 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

The electronic collision processes of greatest importance to aeronomy are those of excitation, deactivation, and attachment. Resonance electron spectrometry experiments relevant to these processes are reported. ESRO

N72-17251 Cambridge Univ. (England). Dept. of Physical Chemistry.
LABORATORY STUDIES OF ELEMENTARY REACTIONS OF NEUTRAL SPECIES CONTAINING O OR H
B. A. Thrush *In* ESRIN Mesospheric Models and Related Expts. 1971 p 231-239 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

A survey of elementary reactions of neutral species containing oxygen or hydrogen is given. Recombination reactions of hydrogen and oxygen compounds are also studied, using gas discharge, electron spin resonance, and chemilumescent methods. ESRO

N72-17252 Oxford Univ. (England). Lab. of Physical Chemistry.
THE PHOTOCHEMISTRY OF OZONE AND SINGLET MOLECULAR OXYGEN IN THE ATMOSPHERE
R. P. Wayne *In* ESRIN Mesospheric Models and Related Expts. 1971 p 240-252 refs (See N72-17235 08-13)
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Some laboratory studies on the photochemistry of the O3-O2-O system are presented with particular reference to the participation of O2 (1 Delta g) in the various processes. These studies have permitted the evaluation of atmospheric models, and the relevance of the studies to atmospheric photochemistry is discussed. The relatively high concentration of O2 (1 Delta g) (produced by photolysis of ozone) suggests that this species plays a significant role in the ion chemistry of the D-region. The possible reactions leading to ion formation are discussed. ESRO

N72-17253 Oxford Univ. (England). Lab. of Physical Chemistry.
LABORATORY INVESTIGATIONS OF THE PRIMARY PRODUCTS OF OZONE PHOTOLYSIS
I. T. N. Jones (Calif. Univ., Los Angeles) *In* ESRIN Mesospheric Models and Related Expts. 1971 p 253-260 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

Measurements of the atmospheric dayglow have shown that O2 (1 Delta g) is the metastable species present in the largest concentration in the upper atmosphere. The photolysis of ozone by ultraviolet is the only atmospheric production mechanism which could produce sufficient quantities of O2 (1 Delta g) to explain the dayglow measurements. A germanium photodiode and intrinsic germanium device were used to detect optical emission of the O2 (1 Delta G) at 1.27 mu. The kinetics of ozone decomposition and O2 (1 Delta g) production during photolysis by 2537 A radiation is studied. ESRO

N72-17254 Bonn Univ. (West Germany). Inst. of Physical Chemistry.
THE AIRGLOW REACTION NO PLUS O PLUS (M) YIELDS NO2 PLUS (M) AT LOW PRESSURES
K. H. Becker, W. Groth, and D. Thran *In* ESRIN Mesospheric Models and Related Expts. 1971 p 261-265 refs Sponsored partly by Bundesmin. fuer Bildung und Wiss. and Landesamt fuer Forsch. des Landes Nordrhein-Westfalen (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

Results on the airglow reaction, nitric oxide plus oxygen, confirming that radiative recombination as well as three body recombination occurs in the pressure region from 0.1 to 50 mm torr are shown. ESRO

N72-17255 European Space Research Inst., Frascati (Italy).
ON THE ORIGIN OF NOCTILUCENT CLOUDS
Giorgio Fiocco and Gerald Grams (Natl. Center for Atmospheric Res.) *In its* Mesospheric Models and Related Expts. 1971 p 266-267 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

Observation results of mesospheric aerosol vertical distribution at times when noctilucent clouds were expected have led to a model for the formation of noctilucent clouds. This model is dependent on the simultaneous presence of dust particles and water vapor. The atmospheric model is analyzed and discussed. ESRO

N72-17256 Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
THE RATE CONSTANTS OF SOME ION-MOLECULE AND ION-ELECTRON REACTIONS, FROM IN SITU IONOSPHERIC MEASUREMENTS
Alain Giraud *In* ESRIN Mesospheric Models and Related Expts. 1971 p 268-272 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

In order to evaluate the validity of upper atmospheric models based on laboratory measured reaction rates, the rate constants of some ion-molecule and ion-electron reactions were determined from in situ F-region measurements and compared with laboratory measurements. ESRO

N72-17257*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROCKET MEASUREMENTS OF ION AND ELECTRON DENSITIES IN THE D-REGION DURING SUNRISE
A. Pedersen (ESTEC) and J. A. Kane *In* ESRIN Mesospheric Models and Related Expts. 1971 p 274-278 refs (See N72-17235 08-13)
(NASA-TM-X-67523) Avail: NTIS; Springer Verlag, New York; D. Reidel, Dordrecht, Neth. CSCL 04A

The results of the rockets launched near sunrise at White Sands, New Mexico, for measuring ion and electron densities in the D-region for 90 deg and 79 deg solar zenith angles are reported. These data are compared with results of previous flights and VLF observations. ESRO

N72-17258 European Space Research and Technology Center, Noordwijk (Netherlands).
ION DENSITIES IN THE LOWER D-REGION MEASURED WITH A PARACHUTED PROBE
R. Jaeschke and A. Pedersen *In* ESRIN Mesospheric Models and Related Expts. 1971 p 279-282 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

A parachute-borne instrument package developed for measuring the lower ionosphere between 80 and 40 km altitude in two ESRO sounding rockets is described. Results from the probe measurements are reported and discussed. ESRO

N72-17259 National Physical Lab., Teddington (England). Div. of Electrical Science.
MEASUREMENT OF SUBMILLIMETER-WAVE STRATOSPHERIC EMISSION SPECTRA
John Chamberlain, W. J. Burroughs, and J. E. Harries *In* ESRIN Mesospheric Models and Related Expts. 1971 p 286-291 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

The submillimeter wave properties of the atmosphere are determined by the water vapor spectrum. The atmospheric gas spectra can be observed in emission from the radiation exchange that can be set up between a spectrometric system and the atmosphere using aircraft. It is necessary to use Fourier transform spectrometry in spectra having medium to high resolution, and acceptable signal-to-noise ratio (S/N) are obtained. Experimental results of sky emission measurements, using a modular Michelson interferometer fitted with PM onboard a Comet 2E aircraft are reported. It is concluded that this technique should be considered in any extensive study of stratospheric constituents using aircraft or balloon-borne equipment. ESRO

N72-17260 National Physical Lab., Teddington (England). Div. of Electrical Science.
SOME EFFECTS OF DIMERS OF THE WATER MOLECULE IN THE ATMOSPHERE
W. J. Burroughs, J. E. Harries, J. Chamberlain, and H. A. Gebbie *In* ESRIN Mesospheric Models and Related Expts. 1971 p 292-298 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

In order to investigate and to explain the excessive absorption observed in atmospheric windows in submillimeter and centimeter spectra absorption, laboratory and in situ experiments were carried out and discussed. Results of the spectroscopic studies of the 7.5 cm feature shows that the necessity to work at low temperatures and pressure. Results of monochromatic absorption measurements show that the excess absorption in the window region can be observed at high temperatures and pressures. ESRO

N72-17261*# Scientific Translation Service, Santa Barbara, Calif.
IONOSPHERIC RESEARCH, NO. 18: COLLECTION OF ARTICLES
A. D. Danilov and L. A. Yudovich, eds. Washington NASA Feb. 1972 263 p refs Transl. into ENGLISH of "Ionosfernyye Issledovaniya, No. 18, Sbornik Statey" Soviet Geophys. Comm., USSR Acad. of Sci. Moscow, Nauka Press, 1969
(Contract NASw-2035)
(NASA-TT-F-655) Avail: NTIS CSCL 04A

Satellite and rocket observations of the ionosphere are presented. The electron density and temperature and ion composition and temperature are measured, along with radio wave propagation. The various instruments used for ionospheric measurement are also reviewed, including pressure gages and mass spectrometers. Author

N72-17262*# Scientific Translation Service, Santa Barbara, Calif.
EXPERIMENTAL DATA ON THE DISTRIBUTION OF BASIC PARAMETERS AND RATES OF PHOTOCHEMICAL PROCESSES IN THE UPPER ATMOSPHERE
A. D. Danilov *In its* Ionospheric Res., No. 18 Feb. 1972 p 1-64 refs (See N72-17261 08-13)
Avail: NTIS CSCL 04A

The state of the art is described on the upper atmosphere characteristics (concentrations of both neutral and charged particles, temperatures, short-wave solar radiation flux) on the basic photochemical processes involving atmospheric components. Author

N72-17263*# Scientific Translation Service, Santa Barbara, Calif.
AMBIPOLAR DIFFUSION OF ELECTRON-ION GAS AND STRATIFICATION OF THE F REGION OF THE IONOSPHERE
V. M. Polyakov *In its* Ionospheric Res., No. 18 Feb. 1972 p 65-95 refs (See N72-17261 08-13)
Avail: NTIS CSCL 04A

The behavior of the F region is examined, aaffected by three competing processes: ionization, neutralization and diffusion of electron-ion gas. The relative role of these processes differs at different levels of the F region. Author

N72-17264*# Scientific Translation Service, Santa Barbara, Calif.
AERONOMIC PROBLEMS ARISING IN THE INTERPRETATION OF ELECTRON DENSITY PROFILES IN THE F REGION
J. Taubenheim *In its* Ionospheric Res., No. 18 Feb. 1972 p 96-113 refs (See N72-17261 08-13)
Avail: NTIS CSCL 04A

In the F region, the balance equation for electron density, including ionization, electron losses, and transfer of charged particles, is dependent on the positive ion balance of atomic oxygen. The ions are produced by photoionization and are converted to $O2(+)$ and $NO(+)$ by the charge exchange occurring before recombination. The individual terms of this

equation are explained. Experimental laboratory and ionospheric investigations give quantitative estimates for ionization and electron losses. Vertical movements were found to vary during the day and especially during a solar eclipse. Author

N72-17265*# Scientific Translation Service, Santa Barbara, Calif.
PRESSURE GAUGE MEASUREMENTS ON ROCKETS AND SATELLITES
V. V. Mikhnevich *In its* Ionospheric Res., No. 18 Feb. 1972 p 114-136 refs (See N72-17261 08-13)
Avail: NTIS CSCL 04A

Techniques are surveyed for measuring the atmospheric density using pressure gages and mass spectrometers onboard rockets and satellites. The disadvantages of using rocket-borne pressure gages are reviewed, such as the lack of atmospheric composition determination and the distortion caused by escaping rocket gases. The pressure gages are used for measuring atmospheric temperature as well as density. Author

N72-17266*# Scientific Translation Service, Santa Barbara, Calif.
RESULTS OF MULTIYEAR OBSERVATIONS OF THE OUTER IONOSPHERE UTILIZING SIGNALS FROM SATELLITES
K. H. Schmelovsky *In its* Ionospheric Res., No. 18 Feb. 1972 p 137-152 (See N72-17261 08-13)
Avail: NTIS CSCL 04A

Signals from satellites were observed regularly at the Kulungsborn observatory since the time that Sputnik-3 was launched. The artificial earth satellite series Cosmos were used as well as the Transit-4a and Explorer 22. Faraday fading of the signals from the Sputnik-3 was investigated at 20 MHz and from Transit-4A at 54 MHz. Faraday fading from the Explorer-22 was registered at frequencies of 20, 40, and 41 MHz as well as the phase shift between coherent frequencies of 20 and 40 MHz. Author

N72-17267*# Scientific Translation Service, Santa Barbara, Calif.
PROBE METHODS FOR STUDYING THE IONOSPHERE
G. L. Gdalevich *In its* Ionospheric Res., No. 18 Feb. 1972 p 153-194 refs (See N72-17261 08-13)
Avail: NTIS CSCL 04A

The methods of investigating the ionosphere using rockets and satellites are divided into two groups: (1) study of radio wave propagation between the satellite or rocket and earth; and (2) measurement of the ionospheric characteristics near the rocket or satellite using instruments installed onboard. The advantages and disadvantages of each method are analyzed. Author

N72-17268*# Scientific Translation Service, Santa Barbara, Calif.
RADIOPHYSICS RESEARCH OF THE IONOSPHERE BASED ON THE PROPAGATION OF RADIO WAVES FROM ROCKETS AND SATELLITES
V. A. Misyura *In its* Ionospheric Res., No. 18 Feb. 1972 p 195-223 refs (See N72-17261 08-13)
Avail: NTIS CSCL 04A

Radio wave effects are examined by direct measurement. They include: Faraday effect, the environmental correction to the Doppler shift, a correction to the phase and group path, refraction, incoherent scattering of radio waves, and other effects. Author

N72-17269*# Scientific Translation Service, Santa Barbara, Calif.
IONOSPHERIC MEASUREMENTS USING THE METHOD OF INCOHERENT SCATTERING OF RADIO WAVES BY THE IONOSPHERE
V. A. Misyura, G. N. Tkachev, V. Ya. Bludov, and Yu. G. Yerokhin *In its* Ionospheric Res., no. 18 Feb. 1972 p 224-272 refs (See N72-17261 08-13)
Avail: NTIS CSCL 04A

Incoherent scattering method for ionospheric parameter measurement in half space around the observation point is described for distances up to a few radii of the earth. This method is used to measure the electron density, along with the temperature of ions and electrons and ion composition. Author

N72-17270*# Scientific Translation Service, Santa Barbara, Calif.
TEMPERATURE MEASUREMENTS OF GROUND AND WATER SURFACES BY AIRCRAFT
D. Lorenz Washington NASA Feb. 1972 33 p refs Transl. into ENGLISH from Pure Appl. Geophys. (Basel), v. 67, 1967 p 197-220
(Contract NASw-2035)
(NASA-TT-F-14140) Avail: NTIS CSCL 08D

A description is given of the measurements made of ground and water surfaces using two different models of IR radiometers, the IT 1 and the PRT 4. The following results were reported: (1) sea-temperature measurements obtained by the IT 1 agreed well with the measurements of water temperature made by lightships, while they differed considerably from those made by coastal stations; (2) measurements of different types of surfaces indicated a strong influence exerted by the type of surface, particularly if covered with vegetation; and (3) measurements made at an angle between 30 and 45 deg to the horizontal yielded results which were not as dependent on the nature of the surface as were perpendicular measurements. Author

N72-17271*# North American Rockwell Corp., Downey, Calif. Space Div.
DEVELOPMENT OF A SATELLITE MICROWAVE RADIOMETER TO SENSE THE SURFACE TERMPERATURE OF THE WORLD OCEANS
G. M. Hidy, W. F. Hall, W. N. Hardy, W. W. Ho, A. C. Jones, A. W. Love, M. J. VannMell, H. H. Wang, and A. E. Wheeler Washington NASA Feb. 1972 278 p refs
(Contract NAS1-10106)
(NASA-CR-1960) Avail: NTIS CSCL 08C

A proposed S-band radiometer for determining the ocean surface temperature with an absolute accuracy of + or - 1 Kelvin and a resolution of + or - .1 Kelvin was placed under the Advanced Applications Flight Experiment for further development into Nimbus readiness state. The results of assessing the following are described: effects due to the state of the sea surface, effevts caused by the intervening atmosphere, and effects associated with imperfections in the instrument itself. An extensive sea truth program is also described for correlation of aircraft test flight measurements or of satellite remote measurement to in-situ data. An improved radiometer design is a modified Dicke-switch type with temperature stabilized, microwave integrated circuit, front-end and with a pulsed injection-noise nulling system. The radiometer has a multimode rectangular horn antenna with very low ohmic losses and a beam efficiency of 98% or better. Author

N72-17272# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
THE ROLE OF APPLICATIONS SATELLITES IN THE MANAGEMENT OF THE HUMAN ENVIRONMENT
Peter A. Castruccio Jun. 1971 28 p Presented at IAF Congr., Brussels, Sep. 1971
(FSC-71-6011) Avail: NTIS

Examples of existing ecological models in selected areas, such as oceanography and hydrology, are presented. Their objectives, mode of operation, and types of input data requirements are described. Avenues for significant improvement in the model's predictive accuracy and for reduction via remote sensing of the cost of gathering the necessary data, are analyzed. Author

N72-17273# National Oceanic and Atmospheric Administration, Rockville, Md.
THE EARTH'S GRAVITY FIELD REPRESENTED BY A SIMPLE LAYER POTENTIAL FROM DOPPLER TRACKING OF SATELLITES
Karl-Rudolf Koch and Bertold U. Witte Apr. 1971 22 p refs
(NOAA-TM-NOS-9) Avail: NTIS

Ten weeks of Doppler tracking of the five satellites for which data are available at the National Space Science Data Center were analyzed to determine the earth's gravity field as represented by the potential of a simple layer. Density values of this layer for 104 surface elements were computed in a least squares adjustment and transformed into harmonic coefficients up to the 11th degree and order. Comparisons with other solutions show good agreement. The results for the equatorial radius of the earth, its flattening, and its gravity at the equator are 6,378,156 m, 1/298.255, and 978,028. 8 m gal, respectively. Author

N72-17274# National Ocean Survey, Rockville, Md.
COMPUTATIONAL PROCEDURES FOR THE DETERMINATION OF A SIMPLE LAYER MODEL OF THE GEOPOTENTIAL FROM DOPPLER OBSERVATIONS
Bertold U. Witte Apr. 1971 67 p refs
(NOAA-TR-NOS-42) Avail: SOD $0.65

The geopotential of the earth is represented by the potential of a simple layer distributed over the earth's surface. Density values of this layer for 104 surface elements were determined from Doppler observations. Computational procedures using this method are presented. Numerical integration is employed to compute satellite orbits with time sequenced Doppler observations given as input. The geopotential forces acting upon the orbit are described as well as the attraction of the sun and moon, solar radiation pressure, and air drag. The results of the orbit fits are combined in an adjustment to determine the density values of the 104 surface elements. Author

N72-17275*# National Aeronautics and Space Administration, Washington, D.C.
FIRST ESRO CONTRACTS FOR A EUROPEAN EARTH RESOURCE REMOTE DETECTION PROGRAM
P. Langereux Feb. 1972 3 p Transl. into ENGLISH from Air Cosmos (France), no. 416, Jan. 1972 p 30
(NASA-TT-F-14130) Avail: NTIS CSCL 08G

Four contracts were awarded for the establishment of a European experimental remote detection program that can be undertaken using airborne resources. Before beginning such a program it will be necessary to ascertain the usable means and their capabilities. Two of the contractors will study the possible uses of radiotelemetry with millimetric waves and side-looking radar, and the other two contractors will conduct an investigation to find an aircraft suitable for installation of remote detection equipment. Author

N72-17276*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
DETERMINATION OF ATMOSPHERIC STRUCTURE FUNCTION BY USING A SINGLE COHERENT DETECTOR
R. H. Lang and P. O. Minott Nov. 1971 23 p refs Submitted for publication
(NASA-TM-X-65804; X-524-71-470) Avail: NTIS CSCL 04A

A technique is described and analyzed for using the single beam laser receiver to measure the wave structure function of atmospheric turbulence. The measurement procedure is as follows: first, the telescope aperture is masked with an opaque screen having two small holes; one hole is covered and the output of the laser receiver is measured; finally, the output of the laser receiver is measured with both holes uncovered. By repeating these measurements for different hole separations, the wave structure function can be derermined. Author

N72-17277# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
INTERDISCIPLINARY MONITORING OF THE NEW YORK BIGHT
W. G. Egan, J. M. Cassin (Adelphia Inst. of Marine Sci., Oakdale, N. Y.), and M. E. Hair (Adelphia Inst. of Marine Sci., Oakdale, N. Y.) Jan. 1972 13 p refs Submitted for publication
(RM-534J) Avail: NTIS

Interdisciplinary physical, chemical and biological measurements were made in the New York Bight during 1969 and 1970 using new in situ instrumentation, with associated monitorlng by conventioanl procedures to check the performance. In situ instrumentation was found to be feasible for the measurement of chlorophyll (and the related biomass), bioluminescence, Gelbstoff, pH, dissolved 02, salinity, and the location of the thermocline. It appears that the in situ instrumentation may be adapted to continuous synoptic monitoring of the estuarine and oceanographic parameters necessary for mathematical modeling. Author

N72-17278*# Translation Consultants, Ltd., Arlington, Va.
ELECTRIC AND THERMAL PROPERTIES OF ROCKS
U. I. Moiseyenko, L. S. Sokolova, V. Ye. Istomin, and E. E. Fotiadi, ed. Washington NASA Feb. 1972 63 p refs Transl. into ENGLISH of the book "Elektricheskiye i Teplovyye Svoystva Gornykh Porod v Usloviyakh Normalnykh i Vysokikh Temperatur i davleniy" Novosibirsk, Nauka Press, 1970
(Contract NASw-2038)
(NASA-TT-F-671) Avail: NTIS CSCL 08G

The results are presented of a study of the electric conductivity of rocks under different thermodynamic conductions. The apparatus and methods used in measuring these parameters are described. Experiments for studying the effect of temperature, pressure, and the joint effect of these factors on rock resistivity are discussed, as well as the results of a study of the thermal properties of sedimentary and igneous rocks at temperatures from room temperature to 1200-1400 C. The dependence of electric conductivity is given for unilateral pressures and with simultaneous heating to 600 C and pressures greater than 30 kbar. The results of a study of the dependence of heat conductivity on temperature are discussed. Conclusions are drawn concerning the mechanism of electric and heat conductivity of rocks at high temperatures. Author

N72-17279# Danish Isotope Centre, Copenhagen.
SOME APPLICATIONS OF RADIOISOTOPES IN COASTAL POLLUTION CONTROL
J. J. Edens May 1971 18 p refs Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6 Sep. 1971
(A/CONF-49/P-646; Conf-710901-307) Avail: AEC Depository Libraries

Applications of radioisotopes in coastal pollution control have been a significant and successful part of the activities of the Danish Isotope Center. The most important field is the utilization of Br-82 (as NH4BR) as a tracer in simulation of discharged sewage in the ocean. Other radioisotope methods are currently employed in water pollution studies, such as the primary production of organic matter is determined by the C-14 method, and mercury content in living organisms, sediments etc., is determined by neutron activation analysis. NSA

N72-17280# Geological Survey, Denver, Colo.
VELOCITY CROSS SECTION 5, EXTENDING SOUTHWEST FROM TATUM DOME, LAMAR COUNTY, MISSISSIPPI
D. Hoye Eargle, R. A. Black, Beth O. Davis, and J. F. Stanford Jr. 1971 11 p
(Contract AT(29-2)-474)
(USGS-474-112) Avail: NTIS

Velocity cross section 5 extends about 18 miles southwest from Tatum salt dome, south-central Lamar County, Miss., to the northeastern part of Washington Parish, La. Cross section 5 shows major sonic velocity zones (and lateral variation of sonic velocity within these zones) for a region within a radius of about

25 miles of Tatum salt dome. Tatum dome is the site proposed for a series of seismic experiments (Dribble Project), for improving the detection of underground nuclear explosions. Data on sonic velocities of the sedimentary rocks surrounding Tatum dome are required for planning of instrumentation for recording the proposed seismic events and in the interpretation of the recorded seismograms. Author (NSA)

N72-17281# Colorado State Univ., Fort Collins. Dept. of Atmospheric Sciences.
RADIOACTIVE FALLOUT AND DISTURBANCES IN THE MID-LATITUDE WESTERLIES
Marvin E. Glasser and Elmar R. Reiter Jul. 1971 37 p refs
(Contract AT(11-1)-1340)
(COO-1340-24) Avail: NTIS

Surface radioactive fallout data for North America are compared with the meridional transport of momentum and with the shear characteristics of atmospheric flow in the lower stratosphere and upper troposphere. Cyclogenetic events during January 1964, their effect on radioactive fallout and on tropopause behavior are examined. Author (NSA)

N72-17282# California Univ., Livermore. Lawrence Radiation Lab.
CALCULATION OF SURFACE AND GROUND WAVES FROM ABOVE GROUND AND UNDERGROUND EXPLOSIONS
Mark L. Wilkins 25 Aug. 1971 18 p refs
(UCRL-73369; CONF-710918-1) Avail: NTIS

The effectiveness of finite difference techniques for the study of wave and ground motions resulting from both above-ground and underground explosions is demonstrated. The accuracy of the calculational technique is established by a comparison with a selected problem that can be solved by other methods for the propagation of Rayleigh waves. Solutions are given for an explosion above the surface and for explosions below the surface. Author (NSA)

N72-17283# Wisconsin Univ., Milwaukee. Dept. of Geological Sciences.
AN INVESTIGATION INTO THE POTENTIAL SEISMOLOGICAL EFFECTS OF THE CANNIKIN EVENT
D. E. Willis, K. G. Poetzl, C. E. Saltzer, A. F. Shakal, and T. L. Woodzick Sep. 1971 239 p refs
(Contract AT(11-1)-2138)
(COO-2138-4) Avail: NTIS

The potential seismological effects of the CANNIKIN underground nuclear shot at Amchitka are discussed. The main three areas of concern were considered to be: (1) generation of a large natural earthquake by the shot, (2) changing the regional seismicity pattern of naturally-occurring events, and (3) possible generation of a damaging tsunami. These studies indicate a very low probability that any damaging effects from the above would result from the CANNIKIN test. Author (NSA)

N72-17284# California Univ., Livermore. Lawrence Radiation Lab.
NUCLEAR EXPLOSION SEISMOLOGY: AEC CRITICAL REVIEW SERIES
Howard C. Rodean 1971 164 p refs
(TID-25572) Avail: NTIS

Unclassified information that is pertinent to the generation of seismic signals by underground nuclear explosions, including the phenomena associated with decoupling and low-coupling techniques to minimize the seismic signals is summarized. These related topics are introduced with a review of the history of nuclear-explosion seismology and a general description of nuclear-explosion phenomena. The fraction of nuclear-explosion energy that is radiated in the form of seismic waves ranges from a few percent down to a few hundredths of one percent. This wide variation is a consequence of corresponding variations in the inelastic response of the material immediately surrounding the explosion. Some insight into inelastic-region phenomena is given by static-equilibrium solutions, but for an understanding of how explosions generate seismic waves, the dynamic process of inelastic-stress-wave propagation must be considered. Several theoretical and experimental examples of inelastic wave propagation, including a recent computer calculation of a 5-kt nuclear explosion in granite, are given. Author (NSA)

N72-17285# Environmental Research Corp., Las Vegas, Nev.
PREDICTED SAN FERNANDO EARTHQUAKE SPECTRA: GLENDALE AREA
J. R. Murphy, R. D. Lynch, and L. J. OBrien Aug. 1971 34 p refs Sponsored by AEC
(NVO-1163-TM-30; TID-4500; UC-35) Avail: NTIS

An analysis of selected aftershocks of the San Fernando earthquake recorded at damage sites in the city of Glendale, California indicates that significant variability in the ground motion spectra occurs within this rather small geographical area. This variability is quantified and used to estimate the main shock ground motion spectra at a number of sites of interest which did not record the main shock. Author (NSA)

N72-17286# Sandia Labs., Albuquerque, N.Mex. Instruments and Sensors Div.
DENSITY OF THE NEUTRAL ATMOSPHERE ABOVE 100 km, KAUAI, MAY - JUNE 1970
R. O. Woods Sep. 1971 18 p refs Sponsored by AEC
(SC-RR-71-0541) Avail: NTIS

Sandia rocket flights 152-119 and 152-118, which took place on the nights of May 26, 1970, and June 6, 1970, carried instrumentation to measure the density of the atmosphere in the range between 120 km and 300 km. The instruments and method of data reduction are described, and results of the experiments are compared to the appropriate standard atmospheres. An annotated bibliography is included. Author

N72-17287# Paris Univ., Orsay (France). Faculte des Sciences.
STUDY OF COLLISIONAL DRIFT AND RESISTIVE GRAVITATIONAL INSTABILITIES IN A DIFFUSION COLUMN Ph.D. Thesis
Michel Touzeau [1971] 89 p refs In FRENCH
(FRNC-TH-73) Avail: AEC Depository Libraries

The characteristics of fluctuations when the two sources of instability occur simultaneously were studied. A system was used allowing a change from a uniform field configuration to one in which the curvature of the magnetic field force lines could be varied. It is experimentally impossible to separate the two types of instability, although it is possible to pass continuously from a situation in which density gradient effects dominate to a situation in which the curvature of the field lines are more important. The experimental results are compared with theoretical predictions. NSA

N72-17288# Weapons Research Establishment, Salisbury (Australia).
PREDICTIONS OF THE OCCURRENCE OF IONOSPHERIC SPREAD F AT NUI DAT
R. F. Treharne Dec. 1970 8 p refs
(WRE-TM-A-193-AP) Avail: AEC Depository Libraries

Predictions are made of the occurrence of spread F at Nui Dat, South Vietnam; these predictions are based on the work of K. Tao of Japan. At this locality spread F occurs primarily in the evening and is strongest in the May-to-July and August-to-October quarters. Author (NSA)

N72-17289# Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.
TRACE ELEMENTS IN NATURAL WATERS Annual Progress Report, 1 Dec. 1970 - 30 Nov. 1971
Karl K. Turekian 31 Aug. 1971 61 p refs
(Contract AT(30-1)-2912)

(YALE-2912-34) Avail: NTIS

During the past year a number of projects undertaken in previous years were brought to their conclusion while others continue to remain in their incipient stages. In the former catagory is work on trace-element determinations on open ocean water samples. In the latter category is work on plankton analyses and the properties of coastal waters and sediments.

Author

N72-17290# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Programs.

CHLORINE AND AIR POLLUTION: AN ANNOTATED BIBLIOGRAPHY

Jul. 1971 108 p refs

(PB-203355; AP-99) Avail: NTIS; GPO $0.55 as stock no. 5503-0018, EP4.9:99 CSCL 13B

A compilation of 162 abstracts of documents and articles on chlorine is presented. These abstracts cover the following categories of air pollution information: emission sources; atmospheric interaction; measurement methods; control methods; effects-human health; effects-plants and livestock; effects-materials; air quality measurement; standards and criteria; and basic science and technology.

GRA

N72-17291# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

STUDIES OF THE ATMOSPHERIC WATER BALANCE

J. L. Rasmassen, D. L. Hadley, R. W. Furman, and Lee K. Balick 1 Aug. 1971 33 p refs

(Grant DI-14-01-0001-1887; OWRR Proj. B-035-Colo)

(PB-202696; W71-12329; Rept-24) Avail: NTIS CSCL 08H

The atmospheric water balance computation is used for two distinctly different kinds of applications. First, the atmospheric water balance is used to infer the exchange of water at the earth's surface over the upper Colorado River Basin. Thirteen winter seasons (1957 to 1969) were studied, twelve-hourly computations were accumulated from November 1, through April 30 and the resulting seasonal accumulation of water was correlated to the succeeding twelve months discharge from the basin. The second application of the water valance technique was centered on the study of the precipitation mechanisms within large extratropical cyclone storm systems.

GRA

N72-17292# Texas Univ., Austin. Antennas and Propagation Div.

SIMULTANEOUS OBSERVATIONS OF DISTURBED CLEAR AIR REGIONS WITH RADAR, PIBAL, AND INSTRUMENTED AIRCRAFT

Alfred H. Lagrone and Andrew P. Deam 30 Jun. 1971 45 p refs

(Grant NSF GA-11462)

(PB-202671; P-46) Avail: NTIS CSCL 04A

One hundred percent correlation was found between disturbed regions detected by difference refractometers with regions detected by S band radar and between regions containing strong vertical wind shear with accelerometer responses for the same region. Richardson's numbers were found to agree well with observed regions of vertical acceleration. At least one radar-detectable region was found that is believed to have contained fossil turbulence. Some low level turbulence was observed that could not be correlated with either radar or difference refractometer detection for the same region.

Author (GRA)

N72-17293# SACLANT ASW Research Center, La Spezia (Italy).

OBSERVATIONS OF AN OCEANIC FRONTAL SYSTEM EAST OF MALTA IN MAY 1971 (MAY FROST)

Ola M. Johannessen, Federico DeStrobel, and Claude Gehin 15 Aug. 1971 30 p refs

(AD-730995; SACLANTCEN-TM-169) Avail: NTIS CSCL 08/3

Some preliminary results are presented from a study of an oceanic front east of Malta that was made in May 1971 using both a ship and an airborne radiation thermometer (ART). During the first nine days of the investigation a major frontal system was located extending southwards approximately along 15 degrees 20 minutes E from the southern part of Sicily to 35 degrees 30 minutes N, at which latitude it curved eastwards, probably due to intruding low-salinity surface-water from the Atlantic. During the second nine days of the cruise the frontal structure and dynamics were studied in detail along latitude 36 degrees N. The temperature structure and the water masses characteristics are described, as well as the response of the front to a sudden increase of the wind speed.

Author (GRA)

N72-17294# North American Rockwell Corp., Downey, Calif. Space Div.

COASTAL BATHYMETRIC PLOTTING Final Report, 1 May - 30 Sep. 1971

David T. Hodder, Phillip B. Chandler, and Gary A. McCue 30 Sep. 1971 57 p refs

(Contract N00014-70-C-0370; NR Proj. 387-048)

(AD-730830; SD-71-763) Avail: NTIS CSCL 08/10

The research is concerned with the development of improved passive techniques for automatic bathymetric plotting in turbid, relatively shallow coastal waters. Initially the technique uses narrower slicing (200 A) bandpass interference filters than have heretofore been utilized in multispectral photography of coastal waters. This is done to reject all of the non-image forming light for bottom photography. Coupled with this is an attempt to adequately characterize (for calibration of the plotting) the water column by a modulation transfer function (MTF) derived either from laser or photographic techniques. Finally, widely-spaced repetitive imagery of identical sites under randomly varying conditions of water column transmission properties were employed to linearly combine, by computer, film isodensity contours. These isodensity contours may be due to combinations of suspended sediment and bottom relief. The former are considered random variations and the latter relatively stable features. This statistical approach has yielded a superior estimate of actual depth contours, since the random sediment effects average out and the bottom features reinforce. Finally, additive multicolor additive processing techniques were examined and found to require normalization for use in the image merging from multiple missions outlined above. This latter work led to an additional spectral reflectivity difference ratioing concept for depth determination and characterizing coastal waters.

Author (GRA)

N72-17295# Defense Documentation Center, Alexandria, Va.

ENVIRONMENTAL POLLUTION: AIR POLLUTION. (EXHAUST GASES), VOLUME 1 Report Bibliography, Feb. 1961 - Sep. 1970

Aug. 1971 92 p refs

(AD-730310; DDC-TAS-71-41-1-Vol-1) Avail: NTIS CSCL 13/2

The annotated bibliography deals with information on air pollution from exhaust gases emanating primarily from ground transportation vehicles; however, included are some references to exhaust systems of jet engines, helicopters, and rocket motors. Corporate Author-Monitoring Agency, Subject, Title, Personal Author, Contract, and Report Number indexes are included.

Author (GRA)

N72-17296# Brown Univ., Providence, R.I. Dept. of Geological Sciences.

INVESTIGATIONS OF P-WAVE ARRIVALS AT LASA Final Report

Michael A. Chinnery Aug. 1971 97 p refs

(Contract F44620-68-C-0082; ARPA Order 292-68; AF Proj. 8652)

(AD-730605; AFOSR-71-2545TR) Avail: NTIS CSCL 08/11

The arrivals of P-waves at the Large Aperture Seismic Array (LASA) from over 3000 earthquakes at various azimuths and distances have been studied. From each set of arrival times a variety of parameters related to the travel time curve are

determined. This report consists primarily of a summary of the principal features of these parameters, as functions of epicentral diytance and azimuth. Author (GRA)

N72-17297# Naval Underwater Systems Center, Newport, R.I. Ocean Science Dept.
BIOLOGICAL OCEANOGRAPHIC INVESTIGATION FROM A DEEP SUBMARINE
Charles L. Brown, Jr. and David Giuliano 29 Jul. 1971 34 p refs
(AD-732451; NUSC-4069) Avail: NTIS CSCL 20/1

The report describes biological observations of the deep scattering layers taken from the deep submergence research vehicle DEEPSTAR 4000, which operated for the Naval Underwater Systems Center between the Gulf of Mexico and the Gulf of Maine from July to October 1967. Generally, more sound scatterers were observed where the DSL was recorded than in the waters above or below these depths. Probably because of the limited number of biological dives conducted, no statistical differences in animal numbers were found between stations over the large geographical range sampled. The report also describes supplementary observations on detritus, visibility, and bioluminescence. Author (GRA)

N72-17298# Texas A&M Univ., College Station. Dept. of Oceanography and Meteorology.
A PREDICTION MODEL FOR THE VARIATION OF THE THERMAL STRUCTURE IN THE OCEAN SURFACE LAYER Ph.D. Thesis
Harold Albert Nagel Aug. 1971 118 p refs
(Contracts Nonr-2119(04); N00014-68-A-0308-0002; TAMRF Proj. 286-11)
(AD-731692; A/M-Ref-71-23-T) Avail: NTIS CSCL 08/10

A numerical model is developed for the simulation of changes of the vertical temperature distribution within the ocean surface layer as a function of time. For imposed meteorological conditions characteristic of winter and summer seasons for two different oceanic regions, the temperature distributions are calculated, and their diurnal variations discussed. The flux of solar radiation and sensible heat within the surface layer of the ocean is evaluated using an equation for the non-steady state transfer of heat. It is assumed that a horizontally uniform temperature exists within an isohaline surface layer of the ocean. Two modes of eddy diffusion of heat are considered in the model, one relating convective thermal diffusion to thermal instability when there is a light wind, and the second mode relating turbulent thermal diffusion to wind stress and wave induced turbulence. Within the water, heat flux by conduction near the air-sea interface is calculated as an implicit function of surface temperature, and the absorption of solar radiation is calculated for nine selected spectral bands. Results indicate that absorption of the near-infrared solar radiation within a few centimeters of the interface is associated with an overlying, unstable, Rayleigh-type convection layer with a calm wind and sea. Author (GRA)

N72-17299# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
THE BAROCLINIC STRUCTURE OF THE FLORIDA CURRENT M.S. Thesis
William Olan Stubbs, Jr. Jun. 1971 68 p refs
(Contract N00014-67-A-0201-0013; NR Proj. 083-060)
(AD-731705) Avail: NTIS CSCL 08/3

Nine consecutive days of free-fall, STD data are analyzed in a study of the baroclinic structure of the Florida Current. Mean values averaged over the nine days are used to reduce tidal aliasing. A southward flow is confirmed during the nine day period. Based on this data and previous works, the southward flow appears to be of a transient nature. Comparison of the directly measured and geostrophically computed current and transport indicates that the Florida Current is essentially in geostrophic balance. Author (GRA)

N72-17300# Naval Oceanographic Office, Washington, D.C.
BIRDS EYE 6-70, 2-15 DECEMBER 1970 Informal Report
R. F. Freeman and M. R. Monroe Oct. 1971 74 p
(AD-732922; NOO-IR-71-7) Avail: NTIS CSCL 08/12

BIRDS EYE 6-70 was a regularly scheduled Arctic Ocean ice reconnaissance mission over areas east and west of Greenland between 2 and 15 December 1970. Ice observations were taken under twilight or moonlight conditions. An infrared scanner operated over the site of recent volcanic activity on Jan Mayen Island. GRA

N72-17301# Naval Research Lab., Washington, D.C. Plasma Physics Div.
HALL CONDUCTIVITY CONTRIBUTIONS TO STRIATION FORMATION IN IONOSPHERIC PLASMA CLOUDS
Sidney L. Ossakow Nov. 1971 14 p refs
(NRL Proj. 77H02-27)
(AD-732748; NRL-MR-2354) Avail: NTIS CSCL 04/1

Hall conductivity contributions to ionospheric plasma cloud striation formation are calculated by considering the case where the ambient electric field is parallel to the equilibrium cloud density gradient and both are perpendicular to the geomagnetic field. The ambient electric field produces Hall currents in the cloud along the density perturbation (assumed perpendicular to the density gradient and magnetic field). Plasma cloud-background ionosphere coupling is included in the analysis. The growth rate of the instability is modified by the ratio of cloud Hall conductivity to cloud Pedersen conductivity compared with the case when the ambient electric field is perpendicular to the density gradient and only Pedersen conductivity contributions are considered. Author (GRA)

N72-17302# Dayton Univ. Research Inst., Ohio.
MEDIUM ALTITUDE CRITICAL ATMOSPHERIC TURBULENCE (MEDCAT) DATA PROCESSING AND ANALYSIS Final Report, 1 May 1969 - 31 May 1971
John P. Ryan, Alan P. Berens, Arthur C. Robertson, Robert J. Dominic, and Kurt C. Rolle 31 Jul. 1971 633 p refs
(Contract F33615-69-C-1750; AF Proj. 1469)
(AD-732878; AFFDL-TR-71-82) Avail: NTIS HC $9.00/MF $0.95 CSCL 04/1

The report describes the processing and analysis phases of the Medium Altitude Critical Atmospheric Turbulence (MEDCAT) Project. The primary objective of this project was to collect true gust velocity in the 20,000 to 40,000 foot altitude regime to be used to establish, validate, and/or modify future aerospace vehicle design criteria. The data, collected by the Air Force from seven bases in the Continental United States, consists of 278 flights performed in the regions of the MEDCAT altitude band predicted by a meteorologist as being most likely to contain clear air turbulence. Two turbulence-instrumented aircraft, an F-106A, and an F-100F, were used to collect the data. Of the 40 hours judged as being in turbulence, 81 percent was characterized as being of less intensity than 1.5 ft/sec rms true gust velocity. Author (GRA)

N72-17303# Rice Univ., Houston, Tex.
IONOSPHERIC HEATING ANALYSIS. HF PLASMA LINE ENHANCEMENTS AT ARECIBO Technical Report, 1 Oct. 1970 - 1 Apr. 1971
William E. Gordon, Herbert C. Carlson, and Robert L. Showen 22 Jun. 1971 21 p
(Contract F30602-71-C-0155; ARPA Order 1423; ARPA Proj. 1E20)
(AD-732884; RADC-TR-71-190) Avail: NTIS CSCL 04/1

Remarkably strong enhancements (factors up to 10,000) of the plasma line were induced in the ionosphere by a powerful transmitter operating at the local plasma resonance frequency and observed by the incoherent scatter radar at Arecibo in January 1971. The intensities and spectral characteristics of the lines shifted upward and downward from the radar probing frequency are reported. The plasma line intensity is related to the power of the exciting wave in a non-linear way. The enhancement

is observed when the exciting wave propagates in the ordinary magneto-ionic mode, but not when the exciting wave is in the extra-ordinary mode. In comparison with the Boulder heating experiment, neither the ionograms nor the photometer records show strong effects. Author (GRA)

N72-17304# Purdue Research Foundation, Lafayette, Ind.
STUDY OF ACQUISITION, EDITING, WEIGHTING AND REDUCTION OF DATA FROM COMPUTER CONTROLLED COMPARATORS Final Report, Feb. 1970 - Aug. 1971
Raymond J. Helmering and Edward M. Mikhail Oct. 1971 201 p refs
(Contract F30602-70-C-0133)
(AD-732885; RADC-TR-71-198) Avail: NTIS CSCL 08/2

Although automation has been applied in many phases of map production, automation in the initial phase of supplemental control generation using analytical methods has not received sufficient attention. Automated photogrammetric systems, which are essentially composed of a precision comparator and a digital computer, have recently become available. To exploit the potential capabilities of these instruments for data acquisition, certain fundamental computational factors must be considered. This research is concerned with some of the more important problems which need to be investigated for efficient employment of such automated equipment. These are methods of data reduction, selection of optimum measurement locations and quality control testing. Author (GRA)

N72-17305# Space Data Corp., Phoenix, Ariz.
SOLID FUEL-GASEOUS OXYGEN REACTION TECHNIQUES FOR PRODUCING HIGH ALTITUDE BARIUM VAPOR CLOUDS Technical Report, 15 Apr. 1970 - 7 Apr. 1971
R. G. Billings, Edward F. Allen, Jr., and Philip E. Beaudoin 7 Apr. 1971 52 p refs
(Contract F30602-71-C-0041; ARPA Order 1057; ARPA Proj. 0E20)
(AD-732887; SDC-TM-506; RADC-TR-71-228) Avail: NTIS CSCL 04/1

The purpose of the program is to develop superior techniques for producing dense barium vapor clouds at high altitudes, using sounding rockets. Several possible vapor production reactions are considered and thermochemical computations are performed comparing achievable efficiencies of yielding free barium at high temperatures. Several prime candidate reactions are evaluated for safety in use and practicality in reactor design. A reactor has been designed for future implementation. Thermochemical computations, ground test results and preliminary flight test observations indicate a large increase in vaporization efficiency over previously used reactions. Author (GRA)

N72-17306# Montana State Univ., Bozeman.
INFRARED TEMPERATURE SENSING OF SNOW-COVERED TERRAIN
Bernard A. Shafer and Arlin B. Super Aug. 1971 104 p refs
(Contract DAHC04-67-C-0058)
(AD-732849; AROD-7166-1-EN) Avail: NTIS CSCL 08/12

The feasibility of remotely monitoring snow surface temperatures was investigated with a Barnes IT-3 infrared thermometer. Much of the work concentrated on determining the vertical emissivity of dry snow in the atmospheric infrared window region between 8 and 14 microns. The emissivity of various snow surface types was measured using an apparatus called an emissivity box. An average emissivity for the freshly fallen snow was found to be 0.975. An analysis of errors in radiometrically obtained snow surface temperatures revealed that the IT-3 is capable of accurately measuring the true surface temperature to within two degrees Celsius for the temperature range experimented. Remote radiometric temperature sensing of snow surfaces appears to offer a potentially useful tool for monitoring surface temperature gradients in arctic environments. Author (GRA)

N72-17307# Army Coastal Engineering Research Center, Washington, D.C.
AN AERIAL PHOTOGRAPHIC TECHNIQUE FOR BEACH EROSION SURVEYS IN NORTH CAROLINA
Donald B. Stafford Oct. 1971 126 p refs
(AD-732833; TM-36) Avail: NTIS CSCL 08/2

The study presents a procedure developed to use existing aerial photographs to survey beach erosion. The use of the procedure is illustrated by data from Onslow and Carteret Counties in North Carolina. A preliminary evaluation of the results obtained in these two counties is given. The procedure is applicable to a variety of conditions and has important advantages over other methods of collecting beach erosion data. The procedure consists of selecting stable reference points on aerial photographs taken in different years and measuring between the stable reference points and points on the transient beach. The measurements are converted to ground distances, and the difference in ground distance is computed. The difference in ground distance represents the change in location of the beach between the dates of the aerial photographs and is converted to an annual rate of change by dividing by the time interval. The change in two locations on the beach, the dune line and the high water line, is determined. Author (GRA)

N72-17308# Norwegian Defence Research Establishment, Kjeller.
NORSAR (NORWEGIAN SEISMIC ARRAY). PHASE 2: INSTALLATIONS 1969 AND 1970 Final Technical Report, May 1969 - 15 Dec. 1970
Mar. 1971 96 p refs
(Contract F61052-68-C-0060; ARPA Order 800)
(AD-732915; NDRE-S-51-Ph-2; ESD-TR-71-372) Avail: NTIS CSCL 08/11

Project NORSAR concerns installation and operation of a large seismic array in S-E Norway. This report covers the field installations of the so-called C-ring subarrays, i.e. 13 of the 14 peripheral subarrays, and also the establishing of a data processing center (DPC) and a maintenance center at Kjeller and telecommunication links between the DPC and the individual subarrays. Author (GRA)

N72-17309# Palisades Geophysical Inst., Blauvelt, N.Y.
A FAST SAMPLING 4 SENSOR SYSTEM FOR THE MEASUREMENT OF SOUND SPEED AND TEMPERATURE IN THE OCEAN USING A SINGLE CONDUCTOR CABLE
Brian R. Turner and Ants T. Piip Jun. 1971 57 p refs
(Contract N00014-71-C-0066; NR Proj. 182-203)
(AD-732383; TR-71-1) Avail: NTIS CSCL 08/10

The report describes a system for accurate in situ measurement of deep sea sound speed and temperature. Two sing around sound velocity sensors are employed together with a precision FM output thermometer and pressure gauge. Frequency multiplexing of the sensor signals permits operation over an inexpensive single conductor cable. A fast scanning rate is obtained by the use of period average counting. Complete circuit details for each part of the system are given, which includes an inverted echo sounder for depth gauge calibration. The system described is the latest generation of data-gathering equipment used in compilation of the Lamont-Doherty Geological Observatory, Columbia University, series of Precision Sound Velocity Profiles In The Ocean, Volumes 1-6. Author (GRA)

N72-17310# Illinois Inst. for Environmental Quality, Chicago.
MERCURY VAPOR EMISSIONS: REPORT ON AERIAL SURVEY OF SOURCES POTENTIALLY AFFECTING THE AIR IN ILLINOIS Final Report
William D. Vaughan and Stephen P. Fuller Jun. 1971 20 p refs
(PB-204520; IIEQ-71-3) Avail: NTIS CSCL 13B

The survey demonstrated the feasibility of rapid aerial detection of mercury emitters. It showed that fossil fuel burning power plants, municipal incinerators, and several industrial sites are emitting measurable quantities of elemental mercury vapor.

Estimates of annual mercury vapor output range from 100 lbs/yr to 5,400 lbs/yr for individual sites. Author (GRA)

N72-17311# Iowa State Water Resources Research Inst., Ames.
REMOTE DETECTION OF MOISTURE STRESS: FIELD AND LABORATORY EXPERIMENTS
Richard Eugene Carlson Jun. 1971 108 p refs
(Contract DI-14-31-0001-3015; OWRR Proj. A-031-IA(5))
(PB-202823; ISWRIR-37; W71-12582) Avail: NTIS CSCL 02D

The wavelength region examined was from 800 to 2,600 millimicns. Leaf reflectivity and leaf adsorptivity were highly correlated with relative leaf water content. The relationship between leaf transmissivity and relative leaf water content was variable with wavelength. Leaf transmissivity was, however, highly correlated with leaf specific densities. The data indicated that a field reflectometer could be constructed and possibly used to monitor leaf water status. In field experiments leaf temperature was significantly affected by relative leaf water content, air temperature, and vapor pressure deficit. Air temperature affected leaf temperature by modifying stomatical conductivities and hence, the leaf transpiration rate. The leaf temperatures of the two soybean varieties were different, dependent upon the dryness of the air. Author(NSA)

N72-17312# Mitre Corp., McLean, Va.
A TECHNOLOGY ASSESSMENT METHODOLOGY. VOLUME 1: SOME BASIC PROPOSITIONS Final Report
Martin V. Jones Jun. 1971 307 p refs 7 Vol.
(Contract OST-26)
(PB-202778-1; MTR-6009-1-Vol-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 05A

A standard, structured method for making studies directed toward anticipating and influencing the societal impacts of new technology applications was developed and is described. Author (GRA)

N72-17313# Mitre Corp., McLean, Va.
A TECHNOLOGY ASSESSMENT METHODOLOGY. VOLUME 2: AUTOMOTIVE EMISSIONS Final Report
Willis E. Jacobsen Jun. 1971 205 p refs 7 Vol.
(Contract OST-26)
(PB-202778-2; MTR-6009-2-Vol-2) Avail: NTIS CSCL 05A

A framework for appraising societal influences of control strategies (technological and nontechnological) for reducing noxious automotive emissions is developed and illustrative examples, based on a proposed cost/benefit model, are presented. Author (GRA)

N72-17314# Mitre Corp., McLean, Va.
A TECHNOLOGY ASSESSMENT METHODOLOGY. VOLUME 4: ENZYMES (INDUSTRIAL) Final Report
David H. Rubin Jun. 1971 226 p refs 7 Vol.
(Contract OST-26)
(PB-202778-4; MTR-6009-4-Vol-4) Avail: NTIS CSCL 05A

Forecasts are presented of likely technological developments and application areas are described in which the impacts have significant societal interactions. Case studies include detergents, biodegradable containers, conversion of dextrose to starch, possible substitute for cane sugar, cellulases, and enzymes used against oil spills. Forecasts are made of the societal impact areas which will be most affected by enzyme techonology. First-order impacts and higher order interactions are presented. Action options are described which could influence the developments of enzyme technology in desirable directions. Author (GRA)

N72-17315# Mitre Corp., McLean, Va.
A TECHNOLOGY ASSESSMENT METHODOLOGY. VOLUME 5: MARICULTURE (SEA FARMING) Final Report
Robert C. Landis Jun. 1971 205 p refs 7 Vol.
(Contract OST-26)
(PB-202778-5; MTR-6009-5-Vol-5) Avail: NTIS CSCL 05A

A general technology assessment methodology is used to determine the impacts of mariculture on the developing countries. The technology is confined to application in coastal and brackish waters. A quantitative impact analysis of economic and social factors is shown for the years 1975-1989. Various action options are offered and a revised impact forecast is given for increased impact on the malnutrition problem. The problems and constraints to accelerated mariculture application are analyzed, and a forecast of 20 million tons of mariculture production in 1985 is made. Also, a subjective probability of which countries will apply mariculture is given. Author (GRA)

N72-17316# Mitre Corp., McLean, Va.
A TECHNOLOGY ASSESSMENT METHODOLOGY. VOLUME 6: WATER POLLUTION: DOMESTIC WASTES Final Report
Victor D. Wenk Jun. 1971 331 p refs 7 Vol.
(Contract OST-26)
(PB-202778-6; MTR-6009-6-Vol-6) Avail: NTIS HC $6.00/MF $0.95 CSCL 05A

A general technology assessment methodology is used to determine the impacts of widespread use of individual home sewage treatment technology during the 1970-1989 time period. The effects of varying rates of diffusion of this technology are analyzed in terms of selected measures of economic and environmental impact. Social and institutional impacts are discussed. Various action options available to identified interest groups are analyzed in terms of their effect upon technology diffusion rates and specific impact areas. The normative nature of this technology assessment called for the use of a dynamic interactive model of the technology diffusion process. Author (GRA)

N72-17317# Mitre Corp., McLean, Va.
A TECHNOLOGY ASSESSMENT METHODOLOGY, PROJECT SUMMARY Final Report
Martin V. Jones Jun. 1971 35 p refs 7 Vol.
(Contract OST-26)
(PB-202778-7; MTR-6009-7-Vol-7) Avail: NTIS CSCL 05A

The findings of the exploratory technology assessment project are summarized. The issues, approach, and conclusions are outlined as well as the individual pilot studies. Author (GRA)

N72-17318# Connecticut Univ., Storrs. Inst. of Water Resources.
AN EXPERIMENTAL STUDY OF AIR AND WATER INTERFACIAL INTERACTION
J. D. Lin 30 Jun. 1971 5 p
(Contract DI-14-01-0001-3007; OWRR Proj. A-021)
(PB-202875; W71-12700) Avail: NTIS CSCL 04A

An experimental study of wind-generated waves was carried out in a wind wave channel under laboratory conditions with and without pressure gradients. A series of experiments was first conducted by boundary layer measurement over a smooth solid surface as a survey of flow characteristics of the channel as well as a basis of reference for the wind waves. The following pertinent quantities were derived from the wind-wave experiment: the profiles of mean velocity and turbulent intensity of wind, the deviation of mean surface from the undisturbed surface of water, the standard deviation of water surface, the energy density spectrum of wind waves and the dominant wave. Author (GRA)

N72-17319# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
COLLECTION AND ASSESSMENT OF AIRCRAFT EMISSIONS BASE-LINE DATA TURBOPROP ENGINES (ALLISON T56-A-15) Final Technical Report, 1 Jun. - 16 Aug. 1971
J. M. Vaught, W. M. Parks, S. E. J. Johnsen, and R. L. Johnson Sep. 1971 70 p refs

(Contract CPA-68-04-0029)
(PB-202961; EDR-7200) Avail: NTIS CSCL 13B

Exhaust emissions data were collected and evaluated from eleven new T56-A-15 military turboprop engines during their production-line performance evaluation. The normal production test schedule was used. Experimental data were analyzed by converting the concentration values measured for each engine to mass emissions over a landing and takeoff (LTO) cycle representative of a commercial flight with T56-type engines and then performing a statistical analysis to obtain mean and standard deviation values. Author (GRA)

N72-17320# Geological Survey, Denver, Colo.
A COMPUTER PROGRAM OF THERMAL MODELING FOR INTERPRETATION OF INFRARED IMAGES
Kenneth Watson 1971 33 p
(PB-203578; USGS-GD-71-023) Avail: NTIS CSCL 08G

An equation for the surface temperature resulting from steady periodic heating of a one-dimensional homogeneous half space is used to model the diurnal surface-temperature variation of the ground for different ground properties, sky properties, and the site latitude and season. Author (GRA)

N72-17321# RAND Corp., Santa Monica, Calif.
A COMPARISON OF TIDAL THEORY WITH LOWER THERMOSPHERIC WIND OBSERVATIONS
E. S. Batten May 1971 17 p refs
(AD-732669; P-4655) Avail: NTIS CSCL 04/1

The wind in the lower thermosphere is generally considered to be composed of prevailing, tidal and gravity wave components. However the observations of the wind, primarily from meteor trail and vapor trail drifts, are available at only a few locations and in the case of vapor trail drifts, only during the night hours. Because of the heterogeneous nature of the data, it has not been possible to definitely specify the contribution of each of these components to the total wind. In an attempt to improve the interpretation of the observations, tidal winds are computed from theory. To do this, the effects of dissipation and excitation in the thermosphere must be considered. In this work, the effects of heat conductivity and the absorption of solar radiation in the thermosphere are added to the tidal theory. Author (GRA)

N72-17322# Coast Guard, Washington, D.C. Oceanographic Unit.
OCEANOGRAPHIC INVESTIGATION OF THE NORTHERN BERING SEA AND BERING STRAIT, 8-21 JUNE
David Husby and Cary L. Hufford 1971 49 p refs
(PB-203586; USCG-373-42; Rept-42) Avail: NTIS CSCL 08J

Physical and chemical data were obtained in the Bering Sea-Bering Strait area during 8-21 June 1969. Distributions of temperature, salinity, dissolved oxygen, inorganic phosphate, nitrate and nitrite are described and interpreted. The deep shelf water of the Bering Sea was traced farther north in June than ever before reported. Author (GRA)

N72-17403# Bureau International des Poids et Mesures, Sevres (France).
RECENT DEVELOPMENTS IN THE ABSOLUTE MEASUREMENT OF GRAVITATIONAL ACCELERATION
A. Sakuma *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 447-456 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17405# National Research Lab. of Metrology, Tokyo (Japan).
A DETERMINATION OF THE ACCELERATION DUE TO GRAVITY AT KAKIOKA, JAPAN
Tadao Inouye, Tomiji Kitsunezaki, Osamu Senda, and Koichi Ando *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 465-468 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17406# National Standards Lab., Sydney (Australia).
THE ABSOLUTE DETERMINATION OF THE GRAVITATIONAL ACCELERATION AT SYDNEY, AUSTRALIA
D. L. H. Gibbings, J. B. Patterson, and G. A. Bell *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 469-474 ref (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17407# Edinburgh Univ. (Scotland).
THE EXPERIMENTAL DETERMINATION OF THE CONSTANT OF GRAVITATION
A. H. Cook *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 475-483 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17408*# Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.
MEASUREMENT OF THE NEWTON GRAVITATIONAL CONSTANT G
W. R. Towler, H. M. Parker, R. A. Lowry, A. R. Kuhlthau, and J. W. Beams *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 485-492 refs Sponsored in part by NASA (See N72-17330 08-14)
(NASA-CR-125578) Avail: NTIS; SOD $6.00 as C 13.10:343 CSCL 08N

N72-17877*# Translation Consultants, Ltd., Arlington, Va.
FREE DIURNAL NUTATION OF THE EARTH BASED ON OBSERVATIONS AT PULKOVO FROM 1915 TO 1928
Ya. S. Yatskiv *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 62-78 refs (See N72-17874 08-30)
Avail: NTIS CSCL 03B

N72-17885*# Translation Consultants, Ltd., Arlington, Va.
DETERMINATION OF THE LATITUDE OF THE MAIN ASTRONOMICAL OBSERVATORY OF THE UKRAINIAN SSR ACADEMY OF SCIENCES (GOLOSEYEVO)
N. A. Vasilenko *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 128-135 refs (See N72-17874 08-30)
Avail: NTIS CSCL 08B

N72-17886*# Translation Consultants, Ltd., Arlington, Va.
DISCUSSION OF THE RESULTS OF LATITUDE OBSERVATIONS AT PULKOVO WITH THE ZTF-135 IN THE EXPANDED PROGRAM DURING 1955.0-1961.3
L. D. Kostina *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 136-154 refs (See N72-17874 08-30)
Avail: NTIS CSCL 08B

N72-17672*# Atomic Energy Commission, Washington, D.C.
TRAPPING OF TRANSURANIUM ELEMENTS BY THE EARTH'S MAGNETIC FIELD
Justin L. Bloom and Bernard J. Eastlund *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 548-555 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17721*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RADIATION MEASUREMENTS AND DOSES AT SST ALTITUDES
Trutz Foelsche *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 894-901 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 04A

N72-17725*# Oak Ridge National Lab., Tenn.
NEUTRON SPECTRAL MEASUREMENTS IN THE UPPER ATMOSPHERE
W. Zobel, T. A. Love, J. T. Delorenzo, and C. O. McNew *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 922-925 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 04A

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N72-17323* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
OPTICAL SYSTEMS HAVING SPATIALLY INVARIANT OUTPUTS Patent
Thomas M. Hard, inventor (to NASA) Issued 7 Sep. 1971 11 p Filed 22 Oct. 1969 Supersedes N70-20732 (08 - 08, p 1445)
(NASA-Case-ERC-10248; US-Patent-3,603,690;
US-Patent-Appl-SN-868445; US-Patent-Class-356-113;
US-Patent-Class-350-162; US-Patent-Class-356-209;
US-Patent-Class-356-244) Avail: US Patent Office CSCL 17H

A description is given of optical systems that have output beams that are spatially invariant to the angle of incidence upon a certain rotatable surface forming a part of the systems, and can be used to select the wavelength of the output of an optical source, such as a laser cavity, or to aid in measuring the reflectance of a material in reflectance spectroscopy. The optical systems comprise various combinations of plane mirrors and plane diffraction gratings (or sample surfaces), in some embodiments, spherical mirrors. The plane mirrors, plane gratings and spherical mirrors are either rotated or fixed in space in accordance with a particular embodiment. By rotating the shaft of the micrometer to a particular incidence angle, the frequency of the output of a laser cavity can be selected. Alternately, the reflectance of a material can be observed for a particular angle. In either case, the output beam remains spatially invariant as the position of the shaft and its attached elements is changed.
Offical Gazette of the U.S. Patent Office

N72-17324* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTIPLE IMAGE STORING SYSTEM FOR HIGH SPEED PROJECTILE HOLOGRAPHY Patent
Robert L. Kurtz, inventor (to NASA) Issued 20 Sep. 1971 3 p Filed 2 Feb. 1970 Supersedes N70-26808 (08 - 13, p 2383)
(NASA-Case-MFS-20596; US-Patent-3,605,519;
US-Patent-Appl-SN-7867; US-Patent-Class-350-3.5) Avail: US Patent Office CSCL 14E

A three beam system is described for obtaining a holographic record on film of a high speed projectile. A coherent beam of radiation is divided into a reference beam, a direct signal beam and a reflected signal beam. The reference beam is directed without modulation to a photographic plate and the direct signal beam is directed to the photographic plate after transmission by the projectile. The reflected signal beam is directed into a beam steerer which allows the synchronous tracking of the projectile with the reflected signal beam. On reflection from the projectile the reflected signal beam is incident on the photographic plate. As the included angle between the reference beam and the reflected signal beam changes multiple images of the target will be stored in the thick emulsion of the photographic plate.
Official Gazette of the U.S. Patent Office

N72-17325* North American Rockwell Corp., El Segundo, Calif.
APPARATUS FOR TESTING WIRING HARNESS BY VIBRATION GENERATING MEANS Patent
David E. Roberts and Sidney M. Grieve, inventors (to NASA) Issued 28 Sep. 1971 4 p Filed 31 Dec. 1969 Sponsored by NASA
(NASA-Case-MSC-15158-1; US-Patent-3,609,535;
US-Patent-Appl-SN-889479; US-Patent-Class-324-52) Avail: US Patent Office CSCL 14B

An apparatus is described which tests wiring harnesses, terminal trips, sockets and plugs. It includes an audio oscillator, an amplifier, and a very substantial high power speaker horn directed at the apparatus being tested, which is positioned immediately in front of the horn. A dc voltage source in series with a load impedance utilizing selected portions of the wiring harness and other associated equipment is included to complete the circuit. An oscilloscope viewing noise developing across the load impedance indicates malfunction of certain parts of the apparatus. Official Gazette of the U.S. Patent Office

N72-17326* Sylvania Electronic Systems-Central, Williamsville, N.Y.
ALTITUDE SENSING DEVICE Patent
John A. Meyer, inventor (to NASA) Issued 7 Sep. 1971 6 p Filed 16 Dec. 1968 Sponsored by NASA Continuation-in-part of abandoned US Patent Appl. SN-417848, filed 11 Dec. 1964
(NASA-Case-XMS-01994-1; US-Patent-3,603,683;
US-Patent-Appl-SN-814212; US-Patent-Class-356-4) Avail: US Patent Office CSCL 14B

A device for signaling critical altitude of a flight vehicle above a landing surface is described that is formed by a high intensity light source. It contains an optical system for reflecting the light beam downwards towards the landing surface and a pair of optical systems that receive reflected images of the illumination produced by the beam. This light responsive electrical system generates a usable voltage signal when the vehicle is at the critical altitude. Official Gazette of the U.S. Patent Office

N72-17327* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SENSING PROBE Patent
Lloyd N. Krause and George E. Glawe, inventors (to NASA) Issued 20 Sep. 1971 3 p Filed 29 Sep. 1969
(NASA-Case-LEW-10281-1; US-Patent-3,605,495;
US-Patent-Appl-SN-861649; US-Patent-Class-73-198) Avail: US Patent Office CSCL 14B

The design and development of a probe for measuring fluid flow pressure and temperature are discussed. A probe with a sensing head in the form of a blunted wedge with flat sides is described. The probe contains a pressure sensing tube and thermocouples to provide the range of measuring capabilities. The sensor can be inserted into a flowing fluid to measure the desired parameters and is small enough to be used in limited areas. Author

N72-17328* Rensselaer Polytechnic Inst., Troy, N.Y.
COINCIDENCE APPARATUS FOR DETECTING PARTICLES Patent
Frederick A. White, inventor (to NASA) Issued 28 Sep. 1971 7 p Filed 15 Jan. 1969
(NASA-Case-XLA-07813; US-Patent-3,609,353;
US-Patent-Appl-SN-791364; US-Patent-Class-250-49.5;
US-Patent-Class-250-41.9; US-Patent-Class-250-71.5;
US-Patent-Class-250-83.3; US-Patent-Class-250-207) Avail: US Patent Office CSCL 14B

An apparatus is described for detecting particles. Particles, depending on their nature, pass through either an aperture in, or the walls of, a cylindrical cathode. The particles create secondary emissions when they impinge on the opposite side of the cathode from their point of entry. The secondary emissions pass out the ends of the cylindrical cathode, through apertures in anodes, and impinge on the electrodes or dynodes of electron multiplier tubes located adjacent to the apertures in the anodes.

The output of the electron multiplier tubes are connected to a coincidence circuit. Due to the symmetry of the overall system, an equal number of secondary emissions are focused by an electrostatic field and impinge on each electron multiplier tube. Hence, emissions lower than the noise level of a single electron multiplier tube can be detected.

Official Gazette of the U.S. Patent Office

N72-17329* Spacelabs, Inc., Van Nuys, Calif.
RESPIRATION MONITOR Patent
Robert J. Fagot, Robert T. McDonald, and James A. Roman, inventors (to NASA) Issued 12 Oct. 1971 5 p Filed 28 Oct. 1968 Sponsored by NASA
(NASA-Case-FRC-10012; US-Patent-3,611,801; US-Patent-Appl-SN-771216; US-Patent-Class-73-194A) Avail: US Patent Office CSCL 06B

A respiration monitor is described than can be inserted directly into a high pressure oxygen line by a capped tube. A hole on the side of the tube allows oxygen to escape into a sealed chamber having an outlet part adapted to be connected to a face mask through a regulator. A microphone placed opposite the hole detects turbulence created by escaping oxygen. A signal from the microphone supplies desired information such as respiration rate and total breaths.

Official Gazette of the U.S. Patent Office

N72-17330# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
PRECISION MEASUREMENT AND FUNDAMENTAL CONSTANTS
D. N. Langenberg (Pennsylvania Univ.) and B. N. Taylor, eds. Aug. 1971 543 p refs Conf. held at Gaithersburg, Md., 3-7 Aug. 1970
(NBS-Sp-343; LC-73-610425) Avail: SOD $6.00 as C 13.10:343

The conference brought together theoretical, experimental, and applied scientists for the purpose of discussing modern techniques of precision physical measurement and their application, along with modern theoretical developments, to the determination of the fundamental constants. The topics covered were: frequency and time standards; length standards; the velocity of light; the Rydberg constant; electrical standards; the proton gyromagnetic ratio; the Faraday constant; atomic masses; the proton magnetic moment; Josephson effects; X-rays; fine and hyperfine structure in simple atoms; lepton g-factor anomalies; the gravitational constants; and least squares adjustments of the constants. For individual titles, see N72-17331 through N72-17414.

N72-17331# National Bureau of Standards, Washington, D.C.
MEASUREMENT STANDARDS, LANGUAGE OF DISCOVERY
L. M. Branscomb *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 3-8 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

Introductory remarks to the international conference are presented. Comparisons between experiment and theory, and what makes the comparison meaningful, are discussed. The need to define, realize, and transfer the basic units of measurement language and the basic questions of physics is considered. It is stressed that the basic units must be not only highly accurate but also defined so as to suffice for the most sophisticated need in science and for engineering, commerce, and general public's use of measurement. The impact of the laser and the Josephson effect on precision measurement is mentioned, and it is pointed out that this is the first conference attended by three groups: theorists exploring basic processes in the framework of quantum electrodynamics, experimentalists interested in precision measurement of fundamental properties, and physicists concerned with perfecting the scientific measurement system. N.E.N.

N72-17332# Laboratoire de l'Horloge Atomique, Orsay (France).
FREQUENCY STANDARDS
C. Audoin and M. Arditi *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 9-16 refs In FRENCH; ENGLISH summary (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

The fundamental physics of the more advanced types of primary atomic frequency standards (cesium beam frequency standard and hydrogen maser) are reviewed. Performances and accuracy limiting factors are discussed, and possible developments are outlined. Author

N72-17333# National Bureau of Standards, Boulder, Colo. Atomic Frequency and Time Standards Section.
ACCURATE FREQUENCY MEASUREMENTS: SURVEY, SIGNIFICANCE, AND FORECAST
Helmut Hellwig and Donald Halford *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 17-25 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

Accurate frequency measurements in the microwave through the infrared regions as well as the imminent realization of frequency measurements in the near infrared and visible regions are surveyed, and their significance on the system of basic standards and fundamental constants is discussed. An exceedingly accurate redetermination of the speed of light, and a single primary standard for frequency, time, and length are imminent possibilities. The further possibility of one primary standard for many (if not all) of the base units exists. Traditional beam techniques, storage methods, and infrared or visible radiation molecular absorptions appear as the most promising candidates for the primary (frequency) standard. Author

N72-17334*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
RECENT DEVELOPMENTS AFFECTING THE HYDROGEN MASER AS A FREQUENCY STANDARD c16
R. F. C. Vessot, M. W. Levine, P. W. Zitzewitz, P. Debely, and N. F. Ramsey *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 27-37 refs Sponsored in part by NASA, NBS, NSF and ONR Prepared in cooperation with Harvard Coll. Obs. and Harvard Univ., Cambridge, Mass. (See N72-17330 08-14)
(NASA-CR-125576) Avail: NTIS; SOD $6.00 as C13.10:343 CSCL 20E

The processes limiting the accuracy and stability of hydrogen-maser frequency-standard systems are described. Recent developments of the maser systems in the following areas are discussed: the temperature dependence of wall shifts; the use of the zero wall-shift temperature to eliminate the wall shift; the deformable storage bulb technique for varying the wall-collision rate; the large-bulb maser; and electronic phase-lock systems and cavity-tuning servos. Author

N72-17335# National Research Council of Canada, Ottawa (Ontario). Div. of Physics.
LENGTH STANDARDS
K. M. Baird *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 39-48 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

The history of length standards is reviewed from ancient times to the present from the point of view of putting into perspective new alternatives to the present international length standard, the 0.606 nm spectral line of Kr-86. Possibilities of some of the new alternatives are discussed including the use of lasers stabilized by the technique of saturated absorption with reference to molecules such as I2, CH4, and CO2 and the use of direct comparison of optical and microwave frequencies. Author

N72-17336# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
INTERFEROMETRY FOR WAVELENGTH COMPARISONS
K. D. Mielenz *In its* Precision Meas. and Fundamental Constants

Aug. 1971 p 53-57 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

For the calibration of Lamb-dip stabilized lasers with respect to the Kr-86 standard, an automated scanning Fabry-Perot etalon was placed in operation which can be operated at lengths of 5 and 10 cm, uses a capacitance-bridge technique for length interpolation, and allows routine wavelength measurements with a precision of 2 times 10 to the minus 9th power. For the wavelength comparison of molecularly stabilized lasers to an expected precision of 10 to the minus 11th power, long Gaussian-beam cavities are illuminated with local-oscillator lasers whose frequencies are either servoed or measured with respect to the stabilized lasers themselves. This apparatus also permits step-scanning the Kr-86-line profile. Author

N72-17337# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
THE USE OF MICROWAVE MODULATION OF LASERS FOR LENGTH MEASUREMENTS c16
Z. Bay *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 59-62 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

The use of the sidebands of microwave modulated laser light in interferometric length measurements permits the establishment of a linear length scale based on the vacuum velocity of light. The length is expressed in terms of microwave frequencies and the measurements are free of diffraction effects. Comparison of the optical wavelength scale and the linear scale based on c permits the determination of optical order numbers and of diffraction phase shifts in interferometers. The limiting accuracies, as dependent upon interferometer imperfections, are similar in measurements based on optical wavelengths and in measurements based on optical frequency determination via microwave modulation techniques. Since optical frequency comparisons and length measurements based on microwave frequencies avoid the use of a wavelength standard without any loss in accuracy, the adoption of a unified standard of time frequency and length via a defined value of the velocity of light can be advocated as soon as c is known to the accuracy of the present length standard. Author

N72-17338# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
THE MEASURING OF OPTICAL FREQUENCIES AND THE VELOCITY OF LIGHT c23
Z. Bay and G. G. Luther *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 63-66 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

Experiments underway for the electrooptic modulation of a 632.8 nm He-Ne laser at X-band microwave frequencies, and for the simultaneous tuning of a Fabry-Perot cavity to both optical sidebands of the modulated laser are reported. The experiments would permit the measurement of the optical frequency and the velocity of light to the same accuracy with the reasonable expectation that those accuracies will exceed the precision of the length standard in future experiments. Possible applications for standardization problems are discussed. The adoption of a unified standard for time interval and length via a defined valued of the velocity of light is advocated. Author

N72-17339# National Bureau of Standards, Boulder, Colo. Radio Standards Physics Div.
DEFINING THE SPEED OF LIGHT: A COMBINATION TIME, FREQUENCY, AND LENGTH STANDARD; RECENT PROGRESS TOWARD MEASURING THE FREQUENCY OF VISIBLE LIGHT c23
K. M. Evenson, J. S. Wells, and L. M. Matarrese *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 67-69 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

The frequencies of the water vapor laser at 3.8 and 10.7 THz (78 and 28 microns) and the P(18) and P(20), 28 THz (10.6 microns) lines of the CO2 laser were measured. This was done by generating a beat note between the unknown radiation and combinations of various harmonics from lower frequency laser and klystron radiations impinging on a tungsten catwhisker-on-nickel diode. Efforts are presently underway to measure the frequency and wavelength of the methane-stabilized 88 THz (3.39 microns) He-Ne laser. Current estimations are that the value of c derived from this combined measurement will be better than 1 part in to the 8th power. It would then be possible to define c as exactly this number, and use the present time and frequency standard as a length standard also. Author

N72-17340# Thompson (J. J.) Physical Lab., Reading (England).
DETERMINATION OF THE RYDBERG CONSTANT
G. W. Series *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 73-82 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

The present situation concerning the Rydberg is reviewed. The value recommended in recent evaluations of constants rests mainly on measurements of wavelengths of H and He(+) lines made over 30 years ago and is subject to systematic errors arising from incomplete resolution of fine structure components. The very thorough studies of the fine structure which were made in recent years, and advances in spectroscopic technique, prepared the ground for a new determination of the Rydberg with substantially improved precision. Author

N72-17341# National Research Lab. of Metrology, Tokyo (Japan).
A NEW DETERMINATION OF THE RYDBERG CONSTANT
Toshiro Masui *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 83-85 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

The Rydberg constant was determined from observation of the two-beam interferogram of H alpha. The hydrogen source is cooled with liquid nitrogen and excited by 50 Hz ac. Observations were made of the order of interference of H alpha in terms of the krypton 86 standard line at path differences up to 3.24 cm and at a discharge current of 10 mA, and of the variation in order of interference at a path difference of 3.24 cm and at discharge currents between 5 and 15 mA. The final result is R sub H = 109 677.593 7+ or -0.003 5/cm. Author

N72-17342# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
DETERMINATION OF THE RYDBERG CONSTANT FROM He II LINE MEASUREMENTS
E. G. Kessler, Jr. and F. L. Roesler (Wisconsin Univ., Madison) *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 87-92 refs Sponsored in part by NSF (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

Detailed studies of the relative positions, relative intensities, and line widths of the He II transitions at 4686, 6560, and 10124 A excited in a cooled hollow cathode were made with a pressure-scanned Fabry-Perot spectrometer. These studies indicate that absolute wavelengths of some of the fine structure components can be measured with sufficient accuracy to improve the precision of the Rydberg constant. A description of the absolute wavelength experiment is given. Large He II line widths limit the accuracy of the absolute wavelength measurements. Two experiments involving excitation processes which show promise of producing narrower lines are briefly described. Author

N72-17343# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
THE FUNDAMENTAL ELECTRICAL STANDARDS: PRESENT STATUS AND PROSPECTS FOR IMPROVEMENT
Robert D. Cutkosky *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 93-99 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

Some of the principal sources of uncertainty in these

experiments based on instruments involving single layer solenoids are analyzed, and, when possible, alternative measurement systems are proposed which could lead to higher accuracy. Within the time scale appropriate for measurements of this kind, absolute resistance measurements based on calculable capacitors are quite recent, even though the first such measurement was reported in 1961. More recent calculable capacitors resulted in absolute resistance measurements of higher accuracy than may reasonably be expected from systems utilizing calculable solenoids. The possibility for improvements in absolute current or absolute voltage measurements does not seem quite so clear, but some ideas are presented which are either now being tried or are worth some consideration. An attempt is made to indicate the more important sources of uncertainty in the proposed systems. Author

N72-17344# Electrotechnical Lab., Tokyo (Japan).
A STARK VOLTMETER AS AN ELECTROMOTIVE FORCE REFERENCE
Ko Hara, Takeshi Kobayashi, Toshimi Matsui, Takahiro Nakase, and Genta Yonezaki *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 101-107 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

An experimental study of an electromotive force reference based on the Stark effect in a molecular rotational transition was made. The spectrometer used was a Stark type with a Fabry-Perot resonator and provided a uniform field by means of a transparent electrode in the resonator. The rotational constant (uncorrected for centrifugal distortion) and the dipole moment were found to be 5273.2503 + or - 0.0006 MHz and 2.06430 + or - 0.00016 debye respectively. The reproducibility of the system as a voltmeter is estimated to be 80 ppm at 350 V/cm. Author

N72-17345# National Physical Lab., Teddington (England).
THE GYROMAGNETIC RATIO OF THE PROTON: A SURVEY c24
P. Vigoureux *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 111-115 (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The gyromagnetic ratio of the proton can be determined in terms of the ampere by two methods: one uses a weak magnetic field, the other a strong magnetic field. Either method used singly yields the constant if a current balance or other dynamometer is also available, but if equipment for both methods is provided, the dynamometer can be dispensed with, and not only the gyromagnetic ratio, but also the ampere, obtained. There may be advantages therefore in building equipment for both methods, especially in laboratories which do not possess a current balance. As however one of the operations in the strong field method consists in weighing a current, the final result is liable to approximately the same uncertainty which affects the weak-field method combined with a current balance. Author

N72-17346# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
APPLICATION OF NUCLEAR RESONANCE TO THE MONITORING OF ELECTRICAL STANDARDS c24
R. L. Driscoll and P. T. Olsen *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 117-121 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

Developments include compensation for earth's magnetic field variations and use of the method of nuclear induction to determine the precession frequency of protons in a magnetic field. Current procedures and recent results are presented. Author

N72-17347# Electrotechnical Lab., Tokyo (Japan).
A gamma sub p' DETERMINATION AT THE ETL; TWO PROPOSALS FOR OBTAINING A UNIFORM CALCULABLE MAGNETIC FIELD FOR AN ATOMIC STANDARD OF CURRENT c23
Ko Hara and Hisao Nakamura *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 123-130 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

Two methods are discussed for obtaining improved calculable magnetic fields for determinations of low field, gyromagnetic ratio of protons. In the first, a single layer solenoid of proper proportion is modified to a solenoid of fourth order uniformity, without any correction coil for uniformity. In the second, a solenoid is confined in a box of high mu material. This gives a calculable uniform field because of imaging effects. A practical arrangement is given for use when mu is not extremely high. In this method, isolation from external fields is achieved. Author

N72-17348# National Physical Lab., Teddington (England).
THE GYROMAGNETIC RATIO OF THE PROTON MEASURED IN A HIGH MAGNETIC FIELD c23
B. P. Kibble and G. J. Hunt *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 131-135 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

Measurements, using a prototype apparatus are reported of the force between a constant current in a coil with parallel vertical sides whose separation is changed by a known amount and a uniform horizontal magnetic field applied to the low end. Simultaneous observation of the precessional frequency of protons in water in the field yields the proton gyromagnetic ratio in the maintained unit of current. Combining the result with that obtained by observing the precessional frequency in the field of a precision solenoid carrying a related current will give the currents and gyromagnetic ratio in absolute units. Author

N72-17349# National Physical Lab., Teddington (England).
THE FARADAY AND ITS SIGNIFICANCE IN DETERMINING THE FUNDAMENTAL CONSTANTS c06
A. Horsfield *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 137-145 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The principles of the electrolysis of solutions of electrolytes are briefly discussed and the Faraday is defined. Experimental methods are given, particularly details of precise determinations of the electrochemical equivalents of silver and of iodine, used in the determination of the Faraday. The accepted value of the Faraday (1970) is 96,487.0 + or - 1.6 coulombs/gram-equivalent. The value of the Faraday, which is the product of the charge of the electron and Avogadro's number, is important in the evaluation of the fundamental physical constants and its role is summarized. Suggestions are made for future experimental work. Author

N72-17350# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
DETERMINATION OF THE FARADAY BY THE IODINE COULOMETER
V. E. Bower *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 147-150 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

A determination of the Faraday by means of the iodine coulometer has been undertaken at the National Bureau of Standards. A progress report is presented. The article describes the iodine coulometer in use at present, the electrical equipment, and also details the chemical analysis of iodine by arsenious acid. The iodine generated in the coulometer can at present, by the method described, be measured with a precision of about 14 ppm (standard deviation of a single observation). Author

N72-17351# Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands).
PRECISION DETERMINATION OF ATOMIC MASSES AND

THE EINSTEIN MASS-ENERGY RELATION c24

A. H. Wapstra *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 151-154 refs (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

The conversion constant between atomic mass and energy units is calculated in a least squares adjustment of atomic mass doublets and nuclear reaction energies. The agreement with the same factor as derived from Einstein's relation is satisfactory and comparable in precision with, but not independent of the value as derived from measurement of the Compton wavelength of the electron. Measurements are proposed that allow an independent check of Einstein's mass-energy relation. Author

N72-17352# Julie Research Labs., Inc., New York.

AN IMPROVED VERSION OF THE NIER CIRCUIT FOR DEL m/m

Loebe Julie *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 155-158 refs (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

In certain types of mass spectrographs delta m/m is accurately related to delta V/V. Using the circuit configuration first described by Nier delta V/V can be determined by the ratio delta R/R, where delta R is a calibrateable rheostat and R represents the resistance of a set of fixed arms. This paper describes an improvement of the Nier circuit, using a recently developed potentiometer circuit in place of the conventional delta R rheostat and fixed resistance arms. In the revised circuit delta V/V is read directly on the dials of an accurate, high resolution Kelvin-Varly divider. Since it is believed that the best available Kelvin-Varley divider has an accuracy and resolution about one order of magnitude better than the best available rheostat the new circuit significantly extends the potential accuracy of delta m/m determinations. This paper also describes a modification of the standard Nier battery circuit which eliminates the problems caused by battery potential shifts and drift during delta m/m measurements. Author

N72-17353# National Physical Lab., Teddington (England). Quantum Metrology Div.

METHODS OF MEASURING THE MAGNETIC MOMENT OF THE PROTON IN TERMS OF THE NUCLEAR MAGNETON c24

B. W. Petley *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 159-167 refs (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

The methods used prior to 1970 to measure the magnetic moment of the proton in nuclear magnetrons are reviewed. The methods discussed include: the proton spin precession, proton cyclotron frequency, low energy methods, and high energy methods. F.O.S.

N72-17354# Wisconsin State Univ., La Crosse.

MAGNETIC MOMENT OF THE PROTON IN NUCLEAR MAGNETONS c24

D. O. Fystrom *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 169-172 refs (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

A redetermination of mu sub p prime/mu sub n using an omegatron similar to that of Sommer, Thomas, and Hipple is reported. Particular emphasis was placed on reducing RF field inhomogeneity and estimating the influence of surface potential variations. Author

N72-17355# National Physical Lab., Teddington (England). Quantum Metrology Div.

MEASUREMENT OF (mu sub p)/(mu sub n) c24

B. W. Petley and K. Morris *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 173-175 refs (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

This paper reports recent measurements of mu sub p/mu sub n with a quadrupole omegatron. The measurements have been made at a flux density of 1.4 tesla and ions of mass 2, 3 and 4 have been used to eliminate the shifts in the cyclotron frequency by electrostatic field gradients. The result of the present series of measurements is that mu sub p/mu sub n is 2.792828 + or - 0.000023 (8.2 ppm) and 2.792754 + or -0.000023 (8.2 ppm) with and without the correction for the diamagnetism of water respectively. Author

N72-17356# Zurich Univ. (Switzerland).

A NOVEL TYPE DETERMINATION OF THE MAGNETIC MOMENT OF THE PROTON IN UNITS OF THE NUCLEAR MAGNETON, (mu sub p)/(mu sub n) c24

H. Gubler, W. Reichart, M. Roush (Maryland Univ.), H. Staub, and F. Zamboni *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 177-180 refs (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

Previous measurements of mu sub p/mu sub n were all based on the determination of the cyclotron frequency of protons circulating in a homogeneous magnetic field whose value was obtained through its proton nuclear spin resonance frequency. In the present experiment, the momentum of highly monochromatic protons (energy 1.3 MeV with less than 100 eV spread) is determined in a 180 deg magnetic spectrometer whose field is measured by its proton nuclear spin resonance frequency. The velocity of the protons is measured with the Los Alamos time of flight spectrometer through which the protons pass before entering the magnetic spectrometer. The results are expected to have an accuracy of at least 20 ppm. Author

N72-17357# Michigan Univ., Ann Arbor. Harrison M. Randall Lab. of Physics.

A NEW TECHNIQUE FOR MEASURING THE CYCLOTRON FREQUENCY OF IONS TO HIGH PRECISION

James L. Luxon and Arthur Rich *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 181-185 refs Sponsored by AEC (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

A new technique is described for measuring ion cyclotron resonance, the magnetic moment of the proton in nuclear magnetons, and the ion mass ratios. The two primary advantages of this method are considered to be: (1) trapping keeps the ions in the RF region for a large number of cyclotron revolutions; and (2) minimization of the electric field shift of the cyclotron frequency, thus isolating the experimental region from electric fields. F.O.S.

N72-17358# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.

COMMENTS ON THE SOMMER, THOMAS, AND HIPPLE OMEGATRON MEASUREMENT OF (mu sub p)/(mu sub n) c24

D. O. Fystrom (Wisconsin State Univ.), B. W. Petley (Natl. Phys. Lab., Teddington, Engl.), and B. N. Taylor *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 187-194 refs (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

The original data books pertaining to the Sommer, Thomas, and Hipple omegatron measurement of mu sub p/mu sub n have recently been examined, and new information concerning the uncertainty to be assigned the experiment has been found. Author

N72-17359# California Univ., Santa Barbara. Dept. of Physics.

MACROSCOPIC QUANTUM PHASE COHERENCE IN SUPERFLUIDS, THEORY c26

D. J. Scalapino *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 195-201 refs Sponsored by AROD

(See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The theory of macroscopic quantum phase coherence is reviewed and its relationship to measurements of fundamental constants are discussed. The off-diagonal matrix elements which characterize this state of matter are introduced and the functional dependence of their phase on the physical constants, potentials, lengths, and times are established. The effects of fluctuations and nonequilibrium conditions on measurements are discussed.
Author

N72-17360# Pennsylvania Univ., Philadelphia. Dept. of Physics.
THE JOSEPHSON EFFECT AS A BASIS FOR DETERMINATION OF FUNDAMENTAL CONSTANTS. EXPERIMENT c26
D. N. Langenberg *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 203-212 refs Sponsored by NSF and ARPA (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The Josephson effect in systems of weakly coupled superconductors or superfluids has recently assumed considerable importance in the determination of several fundamental physical constants. It already provides the basis for the most accurate determination of e/h and promises to yield values of h/m sub e and h/M sub he of significant accuracy in the near future. The experimental properties of the Josephson effect which are important in such determinations are discussed. Achievements to date are reviewed, and possible future developments are described.
Author

N72-17361# Yale Univ., New Haven, Conn. Dept. of Physics.
NOISE IN A JOSEPHSON JUNCTION c26
Patrick A. Lee and Marlan O. Scully (MIT) *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 213-217 refs Sponsored by AFOSR (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The problem is considered of a Josephson junction interacting with a quantized electromagnetic field contained in a microwave cavity. Inasmuch as the cavity has a quality factor Q and an external current J flows in and out of the junction, this is a problem in non-equilibrium statistical mechanics. Using a technique that eliminates adiabatically the radiation field directly from the total density matrix equation of motion, the spectrum of the voltage fluctuations is calculated from which the linewidth of the emitted radiation is obtained. As a consequence of this calculation, it is found that the current-voltage characteristic is slightly modified at finite temperatures. A physical argument for this effect is given and possible experimental observation of this effect is discussed.
Author

N72-17362# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
PULL-IN EFFECT IN JOSEPHSON OSCILLATORS AND AN IMPROVED METHOD OF e/h DETERMINATION c26
V. Kose, H. Fack, F. Melchert, and H.-J. Schrader *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 219-222 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

Constant voltage steps in dc current-voltage characteristics occur by assuming pull-in phenomena of Josephson oscillators. It is demonstrated that the step amplitude depends on the frequency and the amplitude of the external applied signal. A much more accurate measurement system is described for e/h determination than those previously published.
Author

N72-17363# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
REFERENCING OF THE US NATIONAL VOLT AGAINST A JOSEPHSON FREQUENCY-TO-VOLTAGE SOURCE
H. A. Fowler, T. J. Witt, J. Toots, P. T. Olsen, and W. Eicke *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 223-225 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

Intercomparison between the U.S. National Volt group of reference cells, and Josephson voltages at the 2 to 10 millivolt level is reported. High accuracy and precision are achieved through the use of a fixed-element Hamon-pair potentiometer, with amalgam-link switching under stirred oil.
Author

N72-17364# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
MEASUREMENT OF 2e/h BY THE JOSEPHSON EFFECT c26
B. W. Petley and J. C. Gallop *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 227-229 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

Recent work on the measurement of 2e/h is discussed. Work has continued on the use of the solder-drop type of junction and dc measuring techniques were improved, partly by using Hamon resistors.
Author

N72-17365# Pennsylvania Univ., Philadelphia. Dept. of Physics.
PROGRESS TOWARD THE JOSEPHSON VOLTAGE STANDARD: A SUB-PART-PER-MILLION DETERMINATION OF 2e/h c26
T. F. Finnegan, A. Denenstein, and D. N. Langenberg *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 231-237 refs Sponsored by NSF and ARPA (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

An ac Josephson effect determination of 2e/h is described, in which an adjustable (via frequency) Josephson source voltage near 10 mV is compared with a standard cell voltage by means of a fixed 100:1 voltage ratio. Two methods for establishing this ratio were used. One is based on a double series-parallel exchange resistance network, and the other on a double binary resistance chain which is self-calibrated. The ratios obtained with the two methods agree within 0.06 ppm. The precision of the measurements referred to the local voltage standard is better than 0.04 ppm. The accuracy of the measurement, in reference to the National Bureau of Standards (NBS) as-maintained volt is 0.16 ppm and is presently limited by uncertainties in relating the local volt to the NBS as-maintained volt. The demonstrated intrinsic precision of better than 0.04 ppm makes practical the ac Josephson effect as a fundamental solid state voltage standard. The techniques developed in the present measurements also provide sufficient stability and resolution to permit unambiguous studies of the factors which presently limit the reliability of conventional electrochemical voltage standards.
Author

N72-17366# California Univ., Irvine. Dept. of Physics.
MEASUREMENT OF (h/m sub e) USING ROTATING SUPERCONDUCTORS c26
W. H. Parker and M. B. Simmonds *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 243-248 refs Sponsored by NSF (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The fundamental constant (h/m sub e) where m sub e is the free electron mass, was determined from measurements on a rotating superconducting thin-film ring containing a single weak link. The value obtained agrees with the accepted value within the present uncertainty of 0.04 percent.
Author

N72-17367# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
INFLUENCE ON THE FUNDAMENTAL CONSTANTS OF A PRECISE MEASUREMENT OF THE JOSEPHSON EFFECT IN LIQUID HELIUM c26
B. M. Khorana and D. H. Douglass, Jr. *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 249-250 refs (See

N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The possibility is examined of determining the product of (h/M sub He), where h is Planck's constant and M sub He is the mass of the helium atom, by using the analog of the ac Josephson effect in superfluid helium. The implications of such a measurement for the fundamental constants are discussed.
Author

N72-17368# Johns Hopkins Univ., Baltimore, Md.
PROBLEMS IN RELATIVE AND ABSOLUTE MEASUREMENT OF X-RAY WAVELENGTHS c23
J. A. Bearden *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 251-254 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The problem of errors in X-ray wavelength measurements is examined. It is pointed out that the quality of crystals and index of refraction affects wavelength ratios, and that adjustment errors of a double crystal spectrometer produce important wavelength errors. Unexplained discrepancies in recent measurements are discussed. Absolute wavelengths are considered, established by a combination of Avogadro's number with crystal data, ruled grating measurements, and the use of X-ray interferometry.
Author

N72-17369# Johns Hopkins Univ., Baltimore, Md.
RULED GRATING MEASUREMENTS OF THE Al K alpha 1,2 WAVELENGTH c23
Albert Henins *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 255-258 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

An absolute wavelength measurement of the (Al K alpha 1,2) unresolved doublet was made by use of a plane-grating of nearly ideal surface contour. The same wavelength was also measured by a crystal spectrometer with respect to the (Cu K alpha 1) line to obtain the conversion factor, Lambda*. Preliminary analysis of the data yields the wavelength of the (Al K alpha 1,2) as 8.34034 A and the conversion factor Lambda* = 1.000009 A/A* plus or minus 7 ppm P.E.
Author

N72-17370# New Mexico State Univ., Las Cruces.
PRECISION ATOMIC BINDING ENERGIES c24
A. F. Burr *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 259-263 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

A very brief summary of the method for obtaining atomic binding energies for occupied energy levels by means of X-ray line excitation curves is given with some results of measurements performed on cobalt, nickel, lathanum, and cerium. A very condensed description of a method for using (L 11)-(L 111) binding energy differences to obtain an estimate of the Lamb shift for heavy elements is also given.
Author

N72-17371# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
X-RAY/OPTICAL INTERFEROMETRY AND X-RAY FUNDAMENTAL CONSTANTS MEASUREMENTS c23
Richard D. Deslattes *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 265-270 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The status is examined of X-ray measurements implicating numerical values for the constants, in light of recent developments in X-ray/optical interferometry. In reviewing the present state of development of the classical X-ray measurements, particular attention is given to the distribution of weight in their error budgets. A hypothetical X-ray/optical interferometer measurement is schematically described, and the accuracy levels which may be realizable at present and in the near future are indicated. D.L.G.

N72-17372# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium). Studiecentrum voor Kernenergie.
MEASUREMENT OF THE COMPTON WAVELENGTH OF THE ELECTRON c24
P. H. M. VanAssche, J. M. VandenCruyce, G. Vandenput, H. A. Baader, H. R. Koch, D. Breitig, and O. W. B. Schult *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 271-273 refs Prepared in cooperation with Louvain Univ., Tech. Hochschule Munchen, and Danish Atomic Energy Comm., Risoe (See N72-17330 08-14)
Avail: $6.00 as C 13.10:343

Using a bent crystal gamma diffraction spectrometer, the Compton wavelength of the electron has been measured relative to the W K alpha 1 wavelength (expressed in X-units). The annihilation line occurred in presence of the neutron capture gamma ray spectra of Ta. The good resolution of the spectrometer allowed a discrimination against some capture gamma lines superposed upon the annihilation line. The linearity of the spectrometer has been checked with intense capture gamma transitions, observed in different diffraction orders. With this technique a final precision of better than 30 ppm was obtained. The final value was lambda sub c = 24.21269 + or - 0.00077 XU, relative to lambda = 208.5767 + or - 0.0003 XU for the wavelength of the K alpha 1 X-ray of W-182.
Author

N72-17373# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
A POSITRON ANNIHILATION EXPERIMENT FOR DETERMINING THE FINE STRUCTURE CONSTANT c24
William C. Sauder *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 275-278 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

A measurement of the Compton wavelength to one part per million determines the value of alpha to one-half part per million. In this experiment, the Compton wavelength was determined by measuring the wavelength of the gamma radiation produced in two photon annihilation of positronium. A Bragg angle measurement to one ppm was carried out with a two crystal Laue transmission spectrometer capable of angular measurements accurate to 0.001 arc s. The annihilation line was narrowed by allowing the positronium decay to occur in low temperature helium gas in the presence of a magnetic field.
Author

N72-17374# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
OPTICAL INTERFEROMETRY OF THE 220 REPEAT DISTANCE IN A SILICON CRYSTAL c23
R. D. Deslattes *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 279-289 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

Repeat distances in certain highly perfect crystals are more sharply definable than are the wavelengths of X-ray lines. Such repeat distances can be measured in terms of optical wavelengths by coupling a separated plate version of the nondispersive X-ray interferometer of Bonse and Hart to an optical Fabry-Perot in a fashion permitting coordinated scanning. A rather primitive device intended originally for a feasibility study has yielded some preliminary results. Characteristic features of a second generation type device are also described.
Author

N72-17375*# National Physical Lab., Teddington (England).
A NEW DETERMINATION OF AVOGADRO'S NUMBER
I. Curtis, I. Morgan, M. Hart (Bristol Univ., Engl.), and A. D. Milne (Bristol Univ., Engl.) *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 285-289 refs (See N72-17330 08-14)
(NASA-TM-X-67529) Avail: NTIS; SOD $6.00 as C 13.10:343 CSCL 06B

A direct approach to the determination of the Avogadro number using simultaneous optical and X-ray interferometry is

described. The factors potentially limiting the accuracy are discussed in detail and preliminary results are presented. Author

N72-17376# Muenster Univ. (West Germany). Physikalisches Inst.
PRECISION LATTICE PARAMETER MEASUREMENT BY X-RAY INTERFEROMETRY c26
U. Bonse, E. teKaat, and P. Spieker *In* NBS Precision Meas. and Fundamental Constants Aug. 1972 p 291-295 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

An apparatus applying the two crystal LLL-X-ray interferometer to the absolute measurement of the lattice spacing of a silicon crystal is described. Author

N72-17377# Cornell Univ., Ithaca, N.Y. Lab. of Nuclear Studies.
QUANTUM ELECTRODYNAMIC THEORY: ITS RELATION TO PRECISION LOW ENERGY EXPERIMENTS c24
Stanley J. Brodsky (Stanford Linear Accelerator Center) *In* Precision Meas. and Fundamental Constants Aug. 1971 p 297-307 refs Sponsored in part by AEC and NSF Prepared in cooperation with Stanford Linear Accelerator Center (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The key to the unraveling of previous conflicts of theory and experiment has been the ac Josephson junction e/h determination of the fine structure constant alpha and new algebraic and numeric techniques for the evaluation of higher order radiative corrections - especially fourth order contributions to the Lamb shift and sixth order contributions to the electron and muon anomalous magnetic moments. In addition, recent measurements of the muon moment and the hyperfine splitting of muonium now permit a test of QED free of hadronic and weak interaction complications at a precision of 5 ppm. Author

N72-17378# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
THEORY OF THE POSITRONIUM HYPERFINE STRUCTURE c24
Thomas Fulton, David A. Owen, and Wayne W. Repko *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 309-312 refs Sponsored in part by NSF (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

A calculation of recoil correction contributions to the triplet-singlet splitting of the positronium ground state is presented. The result places the theoretical value for the transition frequency approximately one standard deviation above the experimental value. The calculation is performed using a perturbation theory based on the Bethe-Salpeter equation, and a wave function obtained by a single iteration from the non-relativistic Pauli wave function. Author

N72-17379# Yale Univ., New Haven, Conn. Gibbs Lab.
PRECISION MEASUREMENT OF THE FINE STRUCTURE INTERVAL OF THE GROUND STATE OF POSITRONIUM c24
E. R. Carlson, V. W. Hughes, and E. D. Theriot, Jr. *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 313-316 refs (See N72-17330 08-14)
(Grant NSF GP-23722)
Avail: SOD $6.00 as C 13.10:343

Results of an experiment to improve the accuracy of the determination of the fine structure interval of the ground state of positronium to about 10 ppm from its present level of 59 ppm are discussed. An accuracy of 10 ppm will provide a sensitive test of the alpha 4 1n alpha Ry term in theoretical fine structure interval and will necessitate a calculation of the terms of order alpha 4 Ry. Author

N72-17380# Harvard Univ., Cambridge, Mass. Dept. of Physics.
FINE AND HYPERFINE STRUCTURES OF ATOMIC HYDROGEN c24
Norman F. Ramsey *In* NBS Precision Meas. and Fundamental Constants Aug. 1972 p 317-320 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:243

The fine and hyperfine structures of the atomic hydrogen spectrum have been particularly fruitful sources of new developments in physics and the precise measurements of these structures have provided accurate checks on quantum electrodynamics and atomic theory. During the past few years there have been new measurements and new theoretical calculations of the fine and hyperfine structures of atomic hydrogen. These new measurements and theories have removed most of the discrepancies that previously existed between experiment and theory and there is now remarkable agreement between experiment and theory. Author

N72-17381# Yale Univ., New Haven, Conn.
PRESSURE SHIFTS OF HYPERFINE FREQUENCIES IN ONE-ELECTRON ATOMS c24
E. S. Ensberg and C. L. Morgan *In* NBS Precision Meas. and Fundamental Constants Aug. 1972 p 321-325 refs (See N72-17330 08-14)
(Grant AF-AFOSR-0249-67)
Avail: SOD $6.00 as C 13.10:343

Optical pumping methods for hydrogen in argon yield a pressure shift of the hydrogen hyperfine splitting which varies linearly with argon temperature from 5 C to 60 C and becomes less negative with increasing temperature by the amount of (0.20 plus or minus 0.01) percent/degree C for hydrogen and tritium. The fractional pressure shifts for these two isotopes are (-4.803 plus or minus - 0.015) x 10 to the minus 9th power/torr (0 C) at about 26 C. Work continues on deuterium. Results for H and T suggest that the pressure shift of muonium hyperfine splitting should agree with hydrogen to within a few percent. Author

N72-17382# Chicago Univ., Ill. Dept. of Physics.
MEASUREMENT OF THE MUON MAGNETIC MOMENT BY DOUBLE RESONANCE IN MUONIUM, AND A NEW VALUE OF ALPHA c24
A. Magnon, R. DeVoe, P. M. McIntyre, D. Y. Stowell, R. A. Swanson, and V. L. Telegdi *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 327-331 refs (See N72-17330 08-14)
(Grant NSF GP-6035)
Avail: SOD $6.00 as C 13.10:343

Previously any determination of alpha from the hfs splitting of muonium was severely limited by uncertainties in the published magnetic moment of the muon. The magnetic moment has now been determined from the frequencies of two alternative Zeeman transitions. Direct resonances in the Zeeman transitions were obtained by exciting the cavity simultaneously. Results are in good agreement with the TPL recommended value 0.03602. Author

N72-17383# Washington Univ., Seattle. Dept. of Physics.
PRECISION MEASUREMENT OF THE MAGNETIC MOMENT OF THE MUON c24
J. F. Hague, J. E. Rothberg, A. Schenck, D. L. Williams, R. W. Williams, K. K. Young, and K. M. Crowe (Calif. Univ., Berkeley. Lawrence Radiation Lab.) *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 333-336 refs Supported by AEC and NSF (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The ratio of muon to proton magnetic moment has been measured to high precision in sodium hydroxide, distilled water, and methylene cyanide. The agreement showed that the Ruderman correction is not applicable. Author

N72-17384# Princeton-Pennsylvania Accelerator, Princeton, N.J.
MAGNETIC MOMENT OF THE POSITIVE MUON c24
D. P. Hutchinson, F. L. Larsen, N. C. Schoen, D. I. Sober, and A. S. Kanofsky *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 337-338 refs (See N72-17330 08-14)
(Contract AT(30-1)-3217)
Avail: SOD $6.00 as C 13.10:343

The magnetic moment of the positive muon has been measured relative to that of the proton by determining its precession frequency in a magnetic field measured by proton NMR. Measurements were made in water, cyclohexane, and sodium hydroxide. Preliminary measurements of the muon precession frequency in cyclohexane and sodium hydroxide aqueous solution yielded results which were reasonably consistent with the difference of -3.6 ppm expected if the muon had the same relative chemical shifts as the proton. Author

N72-17385# Yale Univ., New Haven, Conn. Gibbs Lab.
HYPERFINE STRUCTURE INTERVAL OF THE GROUND STATE OF MUONIUM c24
P. A. Thompson, D. Casperson, P. Crane, T. Crane, P. Egan, V. W. Hughes, G. zuPutlitz (Heidelburg Univ.), and R. Stambaugh *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 339-343 refs (See N72-17330 08-14)
(Contract F44620-71-C-0042)
Avail: SOD $6.00 as C 13.10:343

The results of the most recent very weak field determinations of the muonium hyperfine structure are reported. Combined with the older data they give a value of delta nu = 4463.308 + or - 0.013 MHz (+ or - 2.9 ppm). The first strong evidence for a nonlinear term in the fractional pressure shift of muonium is presented. Author

N72-17386# Brown Univ., Providence, R.I.
DETERMINATION OF THE ATOMIC HYDROGEN FINE STRUCTURE BY LEVEL CROSSING IN THE 2P STATES OF HYDROGEN: A MEASUREMENT OF THE FINE STRUCTURE CONSTANT c24
J. C. Baird, John Brandenberger (Lawrence Univ., Appleton, Wis.), Ken-Ichiro Gondaira (Univ. of Electrocommun., Tokyo), and Harold Metcalf (State Univ. of N. Y., Stony Brook) *In* NBS Precision Meas. and Fundamental Constants Aug. 1972 p 345-353 refs (See N72-17330 08-14)
(Grants NSF GP-14104; PRF-3205-A5)
Avail: SOD $6.00 as C 13.10:343

The Sommerfeld fine structure constant has been measured by level crossing spectroscopy in atomic hydrogen. The result is alpha = 137.0354(6) where the (6) is the combined statistical and experimental uncertainty and represents a 70 percent confidence level. Experimental and theoretical considerations are presented in the light of contributions to systematic errors which might shift the resultant value of alpha. Author

N72-17387# Michigan Univ., Ann Arbor. Randall Lab. of Physics.
A MEASUREMENT OF THE 2 2S1/2-2 2P3/2 ENERGY SEPARATION, (DEL E-S), IN HYDROGEN (n EQUALS 2) c24
Shynl Tong Wha, R. T. Robiscoe, and W. L. Williams *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 355-360 refs Supported by AEC (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The 2S1/2-2P3/2 energy separation, (delta E-s), in the n equals 2 state of atomic hydrogen, has been measured by an atomic beam radiofrequency method. A beam of metastable atoms in the single hyperfine state was used. The electric dipole transitions were observed at fixed frequencies by sweeping the Zeeman magnetic field parallel to the beam axis. The final value of the (delta E-s) was 9911.250 + or - 0.063 MHz where the quoted uncertainty was one average deviation from the mean. Using the revised experimental value of Lamb shift, S sub H equals 1057.90 + or - 0.10 MHz, delta E equal (10969.15 + 0.12) MHz was obtained. Author

N72-17388# Yale Univ., New Haven, Conn.
A MEASUREMENT OF DEL E-S IN H AND A CORRECTION TO THE MEASURED VALUE OF S IN D c24
T. V. Vorburger and B. L. Cosens *In* NBS Precision Meas. and Fundamental Constants Aug. 1972 p 361-365 refs Supported by NSF (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The 2 2S1/2/2 2P3/2 separation delta E-s in hydrogen has been measured by microwave atomic beam technique. The results obtained from four independent transitions was delta E-s equals 9911.173 + or - 0.042 MHz. This result was combined with the recent determination of the Lamb shift s by Robiscoe to obtain a value for the fine structure splitting delta E and a value for the fine structure constant alpha equals 137.0358(5). A correction is also reported in a previous measurement of the Lamb shift s in D resulting from a beam velocity distribution measurement recently made by Robiscoe and Shyn. The corrected value is 1059.28 + or - 06 MHz. Author

N72-17389# Yale Univ., New Haven, Conn.
MEASUREMENT OF THE 2 2S1/2-2 2P3/2 INTERNAL IN ATOMIC HYDROGEN c24
S. L. Kaufman, W. E. Lamb, Jr., K. R. Lea, and M. Leventhal *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 367-371 refs Supported in part by AFOSR (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The interval 2 2S1/2 - 2 2P3/2 in hydrogen, denoted (weak interaction E - S) sub H, has been determined on the two transitions alpha a (M sub J=+1/2 yields 3/2) and alpha b (M sub J=+1/2 yields +1/2). Details of the microwave-optical experiment are described. The line shape theory is briefly discussed, and the data are summarized. An outline of the treatment of several small corrections is included. The weighted average gives (weak interaction E-S) sub H=9911.377 plus or minus 0.026 MHz. This is compared with a recent theoretical result. Author

N72-17390# Montana State Univ., Bozeman. Dept. of Physics.
ATOMIC BEAMS MEASUREMENTS OF THE FINE STRUCTURE OF H, n EQUALS 2 c24
R. T. Robiscoe *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 373-376 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The most recent experimental systematic corrections to atomic beams measurements of the fine structure of the first excited state of atomic hydrogen are discussed, paying particular attention to those measurements of the Lamb shift S with a claimed accuracy of 0.1 MHz. The newest correction has to do with kinematic effects on the beam velocity distribution. Applying this correction to the so-called level crossing experiments, we find the best expurgated value of S to be 1057.90 plus or minus 0.10 MHz. The result is compared with the most recent theoretical value. Author

N72-17391# Harvard Univ., Cambridge, Mass. Lyman Lab.
SEPARATED OSCILLATORY FIELD MEASUREMENT OF THE LAMB SHIFT c24
C. W. Fabjan and F. M. Pipkin *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 377-381 refs Sponsored in part by the Milton Fund (See N72-17330 08-14)
(Grants NSF GP-8551; NSF GP-22787)
Avail: SOD $6.00 as C 13.10:343

A new technique of observing the Lamb shift, which combines beam-foil and radiofrequency spectroscopy techniques, is described. Measurements are made on fast H-atoms in zero magnetic field by sweeping the frequency of the RF field. It is described how this technique allows the use of Ramsey-separated

oscillatory RF fields with a resulting decrease in the observed line width of the resonance. A RF hyperfine state selector is used to reduce the effect of overlapping lines. Author

N72-17392# Harvard Univ., Cambridge, Mass. Lyman Lab.
MEASUREMENT OF THE LAMB SHIFT IN THE n EQUALS 4 STATE OF HYDROGEN c24
R. A. Brown and F. M. Pipkin *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 383-388 refs (See N72-17330 08-14)
(Grants NSF GP-8551; NSF GP-22787)
Avail: SOD $6.00 as C 13.10:343

Progress on a study of the fine structure in the n=4 state of atomic hydrogen is reported. Measurements are made as a function of the external magnetic field with a fixed radiofrequency field. A pulsed electron beam is used to excite the atoms and the signals are observed in a selected time interval following the excitation pulse. Observations are reported on transitions in both the 4S1/2 yields 4P1/2 and the 4S1/2 yields 4P3/2 complexes. Author

N72-17393# Yale Univ., New Haven, Conn. Dept. of Physics.
DETERMINATION OF THE FINE STRUCTURE CONSTANT ALPHA FROM HELIUM FINE STRUCTURE c24
A. Kponou, V. W. Hughes (Calif. Univ., Berkeley), C. E. Johnson (Calif. Univ., Davis), S. A. Lewis (Mass. Univ.), and F. M. J. Pichanick *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 389-391 refs (See N72-17330 08-14)
(Contract F44620-71-C-0042)
Avail: SOD $6.00 as C 13.10:343

A measurement of v sub 01, the interval between the components J=0 and J=1 of the fine structure in the 2 3P state of helium, has been made by an optical-microwave atomic beam magnetic resonance technique. The result is v sub 01(expt.)= 29,616.864 plus or minus 0.036 MHz (plus or minus 1.2 ppmm). The error is determined primarily by the statistical counting error. This result is 3.09 MHz smaller than the present theoretical value. This difference is presumably due to an uncalculated theoretical term of 0. When this latter calculation is completed it should be possible to determine alpha to 1 ppm. Author

N72-17394# National Bureau of Standards, Boulder, Colo.
PRECISION MEASUREMENT OF THE LAMB SHIFT IN SINGLY IONIZED HELIUM c24
Musti A. Narasimham (Colo. Univ., Boulder) and R. L. Strombotne *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 393-402 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The Lamb shift (S) in the n=2 level of singly ionized helium has been measured by using a microwave method. The experiment has been performed in an applied homogeneous magnetic field at three different operating values for the helium pressure and the result is extrapolated to a zero pressure value. A search has been made for all possible systematic errors in the experiment. The result for S thus obtained is 14046.2 plus or minus 2.0 MHz. This result agrees with the previous experimental values and the theoretical value of 14044.5 plus or minus 5.2 MHz. Author

N72-17395*# Columbia Univ., New York. Dept. of Physics.
PRECISION MEASUREMENTS OF THE FINE STRUCTURE AND LIFETIMES OF THE (1s2s2p) 4P SUB J STATES OF He(MINUS) AND Li RESONANCE c24
Robert Novick and David Weinflash *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 403-410 refs (See N72-17330 08-14)
(Grants NGL-33-008-009; NSF GP-13749)
(NASA-CR-125577) Avail: NTIS; SOD $6.00 as C 13.10:343 CSCL 20H

A series of measurements was completed and others are in progress for the precise determination of the energies and lifetimes of the metastable autoionizing (1s2s2p)4P sub J states in He(-) and Li^+. Since these states have lifetimes in the range from 5 to 500 microsec, and since the fine and hyperfine structure intervals are of the order of a wave number, it will be possible to determine the splitting with a relative accuracy of one part in 1,000,000 or better. Present measurements in Li-6 and Li-7 are at the level of one part in 10,000 and a preliminary estimate was made of the 4P5/2 - 4P3/2 interval in He(-). Work is in progress with radio frequency techniques to obtain more precise results. If the necessary numerical wave functions can be obtained with sufficient accuracy, and if the various radiative and relativistic corrections can be evaluated, these results will provide a precise independent value for the Sommerfeld fine structure constant. Author

N72-17396# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
THE PROTON MOMENT IN BOHR MAGNETONS, AND ALL THAT c24
Daniel Kleppner *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 411-416 refs Sponsored in part by ONR (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The gamesmanship of fundamental constants is explained. The tactics are elucidated by the presentation of a value for the ratio of the proton moment to the electron moment in the ground state of hydrogen. Measurements were made with an atomic hydrogen maser. The result is - mu sub e(H)/mu sub p(H) = 658.210 706 1(65). Author

N72-17397# Wake Forest Coll., Winston-Salem, N.C. Dept. of Chemistry.
THE 1S1/2 BOUND STATE CORRECTIONS TO THE ELECTRON AND PROTON g FACTOR FOR ATOMIC HYDROGEN c24
Roger A. Hegstrom *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 417-420 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

Bound state corrections of orders alpha squared, alpha cubed, alpha squared m/M and higher were calculated for the electron and proton g factors in atomic hydrogen. The method of calculation involved (1) finding a set of mutually commuting operators including the Breit Hamiltonian, (2) partially separating the usual center of mass coordinates by choosing the wave function to be a simultaneous eigenfunction of these operators (3) performing a Foldy-Wouthuysen transformation of the resulting simplified Breit equation, and (4) using first-order perturbation theory, with the nonrelativistic Pauli-Schroedinger eigenfunction as the zero-order wave function, to obtain the g factors. Results were also applied to deuterium, and comparisons were made with experiments and earlier theoretical results. Author

N72-17398# Pennsylvania State Univ., University Park. Dept. of Physics.
ELECTROMAGNETIC INTERACTIONS OF HYDROGENIC ATOMS: CORRECTIONS TO g FACTORS c24
Howard Grotch *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 421-425 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

Corrections to g factors in hydrogenic atoms were obtained from the Breit equation. Explicit wave functions for a slowly moving atom were obtained in the absence of external fields. Interaction with a constant magnetic field was treated perturbatively to obtain bound state corrections to g factors arising from relativistic effects and from nuclear motion. Another method involving a unitary transformation is also discussed. The advantage of this approach is that for a neutral system the unperturbed wave functions are given in the rest frame. Results are compared with experiment; in particular the ratio of g sub e(H)/g sub e(D) is discussed. Author

N72-17399*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RATIO OF ATOMIC g SUB J VALUES FOR HYDROGEN AND DEUTERIUM: A ISOTOPE EFFECT c24
H. G. Robinson (Duke Univ., Durham, N. C.) and William M. Hughes (Duke Univ., Durham, N. C.) *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 427-430 refs Sponsored by NSF and ONR (See N72-17330 08-14)
(NASA-TM-X-67530) Avail: NTIS; SOD $6.00 as C 13.10:343 CSCL 20H

An experimental determination of the (g sub J)(H)/(g sub J)(D) ratio is reviewed. Optical pumping with electron spin exchange detection of H and D Zeeman resonances was used. The applied magnetic field was about 50 G. A discussion of various possible sources of systematic error is given. Recent work indicates that the previous estimate of possible systematic error was too large. The result without estimate of error is (g sub J)(H)/(g sub J)(D) = 1 + (7.2 + or - 1.2) X 10 to the -9th power. This is compared with theory. Author

N72-17400# Mainz Univ. (West Germany).
METHODS FOR LEPTON g-FACTOR ANOMALY MEASUREMENTS c24
G. Graeff *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 431-435 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The experimental methods are described which were used in lepton g factor measurements. In particular, the advantages and disadvantages of the different methods are compared and whether the accuracy of these experiments can be improved is discussed. Author

N72-17401# Michigan Univ., Ann Arbor. Harrison M. Randall Lab. of Physics.
PRELIMINARY RESULTS OF A NEW MEASUREMENT OF THE g-FACTOR ANOMALY OF THE FREE ELECTRON c24
John C. Wesley and Arthur Rich *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 437-442 refs Sponsored by AEC (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The preliminary result of g factor measurement is a = (1 159 644 + or - 7) X 10 to the 9th power, which is in good agreement with quantum electrodynamic theoretical predictions. The role of the constant mu sub p prime/mu sub B (the magnetic moment of the proton in Bohr magnetons, measured in a water sample) is discussed. The NMR techniques used to measure the magnetic field are detailed. Author

N72-17402# European Organization for Nuclear Research, Geneva (Switzerland).
MUON g-2 MEASUREMENTS c24
J. Bailey *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 443-445 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The results of an experiment to measure the anomalous moment of the muon are summarized and compared with theory. New techniques being implemented for improving the measurement are also noted. Author

N72-17403# Bureau International des Poids et Mesures, Sevres (France).
RECENT DEVELOPMENTS IN THE ABSOLUTE MEASUREMENT OF GRAVITATIONAL ACCELERATION c13
A. Sakuma *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 447-456 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

Metrological and geophysical applications of the absolute determination of gravitational acceleration are described and recent work is reviewed. Practical absolute measurements are restricted to two conventional methods, the pendulum and the free motion experiment. The precision of recent measurements by free motion methods is a few parts in 10 to the 9th power (about 1 microgal), two orders of magnitude better than that of absolute determinations prior to 1966. Realization of transportable absolute apparatus is proceeding. The first portable apparatus contributed to the establishment of several absolute sites (0.1 mgal or better) in North America, and also to mutual verification of the accuracy of measurements at two existing absolute sites: Teddington and Sevres. Agreement to better than 0.1 mgal was obtained between these three absolute determinations. It is therefore believed that there are now no significant systematic errors in the determination of the absolute gravitational acceleration in North America and Europe. Perturbing effects in gravity measurement are analyzed. Author

N72-17404# Colorado Univ., Boulder.
A LASER-INTERFEROMETER SYSTEM FOR THE ABSOLUTE DETERMINATION OF THE ACCELERATION DUE TO GRAVITY c16
James A. Hammond and James E. Faller (Wesleyan Univ., Middeltown, Conn.) *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 457-463 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

A portable instrument for making an absolute determination of the acceleration due to gravity was built. The design and construction of this apparatus, together with the results obtained at eight different sites, are discussed. The instrument consists of an optical interferometer illuminated by light from a stabilized He-Ne laser in which one of the mirrors, a corner cube reflector, freely falls a total distance of about one meter. The drop to drop scatter is less than 1 part in 10 to the 7th power, and the uncertainties (70% confidence intervals) of the results obtained at most sites are less than + or - 5 parts in 10 to the 8th power. Author

N72-17405# National Research Lab. of Metrology, Tokyo (Japan).
A DETERMINATION OF THE ACCELERATION DUE TO GRAVITY AT KAKIOKA, JAPAN c13
Tadao Inouye, Tomiji Kitsunezaki, Osamu Senda, and Koichi Ando *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 465-468 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The measurement was based on the free fall method using a 1-meter graduated scale. The obtained gravity value was 9.799648 m/sec sq with the assigned error of 0.00001 m/sec sq. This value is 0.0000153 m/sec sq smaller than the value based on the Potsdam system. From analysis of the observational data, it was found that some of the experiments were affected by microseisms. Author

N72-17406# National Standards Lab., Sydney (Australia).
THE ABSOLUTE DETERMINATION OF THE GRAVITATIONAL ACCELERATION AT SYDNEY, AUSTRALIA c13
D. L. H. Gibbings, J. B. Patterson, and G. A. Bell *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 469-474 ref (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The determination was made by studying the free motion of a body projected vertically upwards in a vacuum and the time between its initial and final passages through two horizontal planes of known vertical separation was measured. The measured value of g at a point 1.2 meters above the floor was 9.796134 m/sec sq. The corresponding value at floor level at the BMR gravity station is 9.796717 m/sec sq. Author

N72-17407# Edinburgh Univ. (Scotland).
THE EXPERIMENTAL DETERMINATION OF THE CONSTANT OF GRAVITATION c13
A. H. Cook *In* NBS Precision Meas. and Fundamental

Constants Aug. 1971 p 475-483 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The principal determinations of the constant of gravitation are reviewed, from Cavendish to Heyl. The main sources of error are discussed and the reasons for the poor precision of all work are considered. Brief mention is made of the determination in progress at the University of Virginia, and the plans for a determination at Trieste are described. Author

N72-17408*# Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.
MEASUREMENT OF THE NEWTON GRAVITATIONAL CONSTANT G c13
W. R. Towler, H. M. Parker, R. A. Lowry, A. R. Kuhlthau, and J. W. Beams *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 485-492 refs Sponsored in part by NASA (See N72-17330 08-14)
(NASA-CR-125578) Avail: NTIS; SOD $6.00 as C 13.10:343 CSCL 08N

A method for measuring the gravitational constant G utilizes a modified Cavendish arrangement in which the gravitational interaction between a large mass system and a small mass system produces a torque on the latter. A rotary table carrying the large masses is servoed to constant relative geometry with respect to the small mass system. The angular acceleration of the table and the other appropriate parameters are measured. Further improvements in the method and noise reduction are described, and the ultimate potential accuracy of the method is discussed. Author

N72-17409# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
HANDLING OF DISCREPANT DATA IN EVALUATIONS OF THE FUNDAMENTAL CONSTANTS
P. L. Bender *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 493-494 (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

A compromise procedure is proposed in which the evaluator estimates probabilities for the correctness of each of the possible methods of handling the data and arrives at a final mean and standard deviation using appropriately weighted results of all the methods. Author

N72-17410# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
COMMENTS ON LEAST-SQUARES ADJUSTMENTS OF THE CONSTANTS c19
B. N. Taylor *In its* Prec. Meas. and Fundamental Constants Aug. 1971 p 495-498 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 10.13:343

Opinions formed during the preparation of the 1969 constants adjustment based on the Josephson effect measurement of 2e/h, are given with regard to the general utility of carrying out adjustment studies, methods for handling inconsistent or discrepant input data, how errors should be treated and assigned, how experiments should be reported, etc. Author

N72-17411# North American Rockwell Corp., Thousand Oaks, Calif. Science Center.
IN DEFENSE OF LEAST-SQUARES ADJUSTMENTS c19
E. Richard Cohen *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 499-501 ref (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

In the approximation of linear functions, assuming that the best estimate of a quantity based on several observations of equal accuracy is the mean of the observations, it is shown that the usual relationships of the method of least squares can be derived without any reference to quadratic forms or the minimization of squares. Author

N72-17412# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
SOME ASPECTS OF LEAST-SQUARES ADJUSTMENTS OF CONSTANTS c19
John S. Thomsen *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 503-505 (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

The need for a least squares adjustment to obtain recommended values for fundamental constants is reviewed and its advantages briefly discussed. The question of the best form of error criterion is considered. When systematic effects are predominant, probable error appears to be the most intuitive concept and the one least likely to be misinterpreted. The problem of rejection of discrepant data is discussed. It may be preferable to increase the error and thus lower the weight of such an item, rather than to reject it entirely. An example is given in terms of mu sub p prime/mu sub m, the magnetic moment of the proton in units of the nuclear magneton. Author

N72-17413# Michigan Univ., Ann Arbor. Dept. of Physics.
COMMENTS ON THE ASSIGNMENTS OF EXPERIMENTAL UNCERTAINTIES
Peter Franken *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 507-508 (See N72-17330 08-14)
Avail: SOD $6.00 as c 13.10:343

The uncertainty assigned to a precision measurement ideally should not be solely determined by random measurement errors, but should be partly the result of subjective judgments by the experimenter on the accuracy of his work. A method based on a betting procedure is recommended. Author

N72-17414# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
CONTRIBUTION TO PANEL DISCUSSION ON ADJUSTMENTS OF THE FUNDAMENTAL CONSTANTS c19

Churchill Eisenhart *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 509-525 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

Trial of alternative adjustments determined by criteria of least sum of absolute residuals and least maximum residual is suggested as a check on the credibility of least squares adjustments. References are given on implementation of these alternatives. An example is given of disparate values whose averaging is unwarranted. Several sets of data are discussed. When systematic differences among subsets of measurements of a single quantity are evident, or revealed by statistical analysis, use of the unweighted mean of the subset means is recommended, rather than a weighted mean. It is concluded that nonoverlap of the limits of uncertainty assigned to two or more determinations of the same quantity stems from underestimation of the standard deviations of the respective means due to insufficient sampling of relevant conditions in the experiment, and the use of computational procedures that fail to take proper account of between-subset components of variance. Author

N72-17415*# Barnes Engineering Co., Stamford, Conn
DEVELOPMENT OF IMPROVED PYROELECTRIC DETECTORS; LITERATURE SURVEY OF PYROELECTRIC MATERIALS AND THEIR CHARACTERISTICS Quarterly Technical Report, Aug. - Nov. 1971
Seymour Weiner and Henry P. Beerman 29 Nov. 1971 69 p refs
(Contract NAS5-21655)
(NASA-CR-122334; BEC-2064QR1) Avail: NTIS CSCL 14B

The object of this program is to improve the detectivity of the pyroelectric detector with the ultimate goal of operation at or near the temperature-noise limit. Two general areas of investigation are undertaken. The first is to improve responsivity through the use of new materials. The second is directed toward reduction of noise and will be effected with improved field effect transistor characteristics, and improved electroding of the

pyroelectric material. The search for new materials has begun with a review of the literature on pyroelectric materials in several languages. The compiled data includes an extensive list of references. From this, several materials have already been selected for investigation. FETs are being obtained from various manufacturers, evaluated, and selected units will be tested with pyroelectric elements as complete detectors. Author

N72-17416*# Martin Marietta Corp., Orlando, Fla.
STUDY PROGRAM OF NASA/GSFC WELD QUALITY MONITOR SYSTEM Final Report, Apr. - Sep. 1971
Wendell R. Hutchinson Nov. 1971 89 p
(Contract NAS5-21395)
(NASA-CR-122335) Avail: NTIS CSCL 14B

The Weld Quality Monitor has provided online control through the application of linear transducers. The electronic systems must be upgraded to increase confidence level required in production. The Weld Quality Monitor has been used with a recent model solid state power supply to evaluate ability to differentiate between sound and defective weld joints. The Weld Quality Monitor has been evaluated on Dumet and Kovar to interconnect materials Nickel and Alloy 180 in weld joints used on microelectronic module fabrication. Distinct separation was achieved between low strength welds and sound welds by the Quality Monitor. Evaluation performed indicates a drift level at less than 2 percent on a series of 50 consecutive welds. Operation under shop conditions identified need for controlled electrode impact. This was achieved with pneumatic a ctuation. Author

N72-17417*# GCA Technology Div., GCA Corp., Bedford, Mass.
AE MASS SPECTROMETER ANTECHAMBER STUDY Final Report
Richard F. Herzog Nov. 1971 47 p
(Contract NAS5-11368)
(NASA-CR-122346; GCA-TR-71-4-N) Avail: NTIS CSCL 14B

The formation of CO2 and H2O in a gold plated antechamber was investigated when a beam of oxygen is introduced. It was found that at room temperature the formation of CO2 and H2O is negligibly small. However, at the top temperature (197 C) which could be achieved with the existing system, both products were formed in significant quantities. Desorption of CO2 and H2O at this temperature is still slow and incomplete which accounts for the delayed response to the beam conditions. Although the catalytic reactions take place already with molecular oxygen, the reactions are significantly enhanced if the oxygen beam is partially disso ciated. Author

N72-17418*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO 12 LUNAR PHOTOGRAPHY, NSSDC ID NO. 69-099A-01 Data Users' Note
A. T. Anderson, C. K. Michlovitz, and K. Hug Jul. 1970 26 p refs
(NASA-TM-X-68808; NSSDC-70-09) Avail: NTIS CSCL 14E

Information on the complete set of Apollo 12 photographs is presented to aid the investigator in the selection and interpretation of photographs. Film type and size, magazine, frame numbers, and identifying remarks are given for the 70-mm coverage, S-158 multispectral coverage, 16-mm coverage, and 35-mm stereo coverage. Background information on mission objectives, photographic equipment, and photographic coverage and quality is included. N.E.N.

N72-17419*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 12 PHOTOGRAPHY 70 mm, 16 mm, AND 35 mm FRAME INDEX
Greenbelt, Md. Jul. 1970 152 p
(NASA-TM-X-68810; NSSDC-70-11) Avail: NTIS CSCL 14E

For each 70-mm frame, the index presents information on: (1) the focal length of the camera, (2) the photo scale at the principal point of the frame, (3) the selenographic coordinates at the principal point of the frame, (4) the percentage of forward overlap of the frame, (5) the sun angle (medium, low, high), (6) the quality of the photography, (7) the approximate tilt (minimum and maximum) of the camera, and (8) the direction of tilt. A brief description of each frame is also included. The index to the 16-mm sequence photography includes information concerning the approximate surface coverage of the photographic sequence and a brief description of the principal features shown. A column of remarks is included to indicate: (1) if the sequence is plotted on the photographic index map and (2) the quality of the photography. The pictures taken using the lunar surface closeup stereoscopic camera (35 mm) are also described in this same index format. Author

N72-17420*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO 12 70 mm PHOTOGRAPHIC CATALOG
Jul. 1970 313 p
(NASA-TM-X-68811; NSSDC-70-10) Avail: NTIS HC $6.00/MF $0.95 CSCL 14E

Proof prints of the 70-mm photography are presented, sorted by magazine and frame number. The 28 lunar surface panorama mosaics and a listing of the mosaics are included. The catalog is designed to be used in conjunction with the 'Apollo 12 Photography: 70-mm, 16-mm, and 35-mm Frame Index', which makes it possible to locate the area covered by each frame. Author

N72-17421*# Ball Bros. Research Corp., Boulder, Colo.
CIT PHOTOHELIOGRAPH DEFINITION STUDY. VOLUME 3: DEVELOPMENT PROGRAM PLAN Final Report
Apr. 1971 55 p refs 4 Vol.
(Contract NAS8-30190)
(NASA-CR-119781; F71-02-Vol-3) Avail: NTIS CSCL 14B

The development plan for phase C (design) and phase D (development/operations) are presented. The C and D plan includes program requirements, supporting research and technology, system design, manufacturing plan, procurement, calibration, and functional tests. An analysis of the program schedule is also included. F.O.S.

N72-17422*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERMEAMETER FOR HIGH-TEMPERATURE MAGNETIC MEASUREMENTS
John P. Barranger Washington Feb. 1972 9 p refs
(NASA-TN-D-6659; E-5964) Avail: NTIS CSCL 14B

A permeameter is described that measures the magnetizing force and the corresponding magnetic induction up to 1000 C. The two symmetrical yokes are made of an alloy of 9 percent iron, 91 percent cobalt. A coil surrounding the specimen supplies a magnetizing force of up to 100 oersteds. The instrument uses the magnetic potentiometer principle to cancel the effects of the reluctance of the yoke and the joint gaps. Very close agreement was obtained at room temperature when compared to an MH type permeameter. The effect of temperature on the normal induction curves for the yoke material is also presented. Author

N72-17423*# Virginia Univ., Charlottesville. Div. of Electrical Engineering.
A FORCE BALANCE SYSTEM FOR THE MEASUREMENT OF SKIN FRICTION DRAG FORCE Final Report
J. W. Moore and E. S. McVey Nov. 1971 61 p
(Grant NGR-47-005-026)
(NASA-CR-112011; EME-4029-112-71U) Avail: NTIS CSCL 14B

Research on force balance instrumentation to measure the skin friction of hypersonic vehicles at extreme temperatures, high altitudes and in a vibration field is discussed. A rough overall

summary and operating instructions for the equipment are presented. Author

N72-17424# Center for Experiment Design and Data Analysis, Rockville, Md.
BOMEX FLIGHT TRACKS RECONSTRUCTED FROM NEAR-SIMULTANEOUS HIGH LEVEL CLOUD PHOTOGRAPHY BY TWO AIRCRAFT
Vance A. Myers and Martin Predoehl Dec. 1971 17 p refs
(NOAA-TM-ERL-BOMAP-8) Avail: NTIS

Near simultaneous high level photography of clouds by two aircraft during the Barbados Oceanographic and Meteorological Experiment (BOMEX) gives some clues to the precision of navigation on this type of mission. Photographs were taken from 50,000 and 60,000 ft., respectively, on two days during BOMEX Period 3. On one of the days, the assigned flight track separation of 35 n. mi. is roughly verified, but on the other day the actual separation was found to be less. Examples of the dual photography are shown. Author

N72-17425# Joint Publications Research Service, Washington, D.C.
ANGULAR ACCELEROMETER
V. M. Subbotin 9 Feb. 1972 7 p refs Transl. into ENGLISH from Priborostroyeniye (Leningrad), no. 4, 1971 p 83-86
(JPRS-55145) Avail: NTIS

An angular accelerometer with a blade damper on a torsion arm was examined. A comparative evaluation was conducted with a conventional inertia angular accelerometer for sensitivity. Relationships for parameter selection are given. The possibility of obtaining a signal of the first derivative of acceleration is shown. Author

N72-17426*# Columbia Union College, Takoma Park, Md. Physics Dept.
DESIGN AND CONSTRUCTION OF A WIDE ANGLE DIFFUSE SOURCE
E. I. Mohr Oct. 1971 33 p refs
(Grant NGR-21-023-001)
(NASA-CR-122345) Avail: NTIS CSCL 14B

A Multispectral Scanner (MSS) has been under development for some time and is now undergoing tests for final calibration. It has four bands, each containing six channels. Thus it has 24 detectors which receive radiation by fiber optics. It is shown that a spherical integrator makes a satisfactory extended source for the calibration of the scanner. Author

N72-17427# California Univ., Livermore. Lawrence Radiation Lab.
MICROWAVE ROTATIONAL SPECTROSCOPY APPLIED TO TRACE-GAS POLLUTANT MONITORING
Lawrence W. Hrubesh 3 Aug. 1971 8 p refs Presented at Joint conf. on Meas. of Environ. Pollutants, Palo Alto, Calif., 8 Nov. 1971 Submitted for publication Sponsored by AEC
(UCRL-73197; Conf-711102-1) Avail: NTIS

The properties of microwave rotational spectroscopy that make it a promising technique for gaseous pollutant monitoring are presented. Recent advances in instrumentation and technique that have suggested feasibility of in situ monitoring are thoroughly discussed. A laboratory model of a potentially portable Gunn-diode cavity spectrometer has been interfaced to the atmosphere by way of a multistaged membrane separator. Results of testing this system under controlled experimental conditions as a specific monitor for several common gaseous pollutants are given. Determinations of the optimum sensitivity, specificity, and stability expected for this system are discussed along with considerations for its calibration. Author

N72-17428# Mason and Hanger-Silas Mason Co., Inc., Burlington, Iowa.
STATIC DETECTOR
H. A. Hanna 6 Jan. 1971 24 p refs
(Contract W-49-010-AMC-68(A))
(MHSMB-24; TR-201) Avail: NTIS

The static detector is suitable for use as a safety appliance in any operation or process which involves explosive or flammable materials, liquids, dusts of fumes which are subject to ignition by static discharges. The device is also applicable to operations where efficiency or product quality is adversely affected by static electricity or stray electromagnetic fields. The detector provides a warning light whenever electrical energy levels exceed a preset safety limit. Accessories for the device provide for a remote visual and audible alarm. Features of the static detector include a small size, and extremely low cost, portability and a sensitivity which provides adequate detection limits for any known explosive or flammable material. No special training of personnel is required for the proper operation of the detector. However, consultation with an engineer knowledgeable in static electricity and electromagnetic hazards may be helpful for obtaining the most effective use of the device. Author

N72-17429# Sandia Labs., Albuquerque, N.Mex. Special Test Equipment Design Div.
DEVELOPMENT OF AN ELECTRIC MANOMETER TESTER
Everett G. Hayes Oct. 1971 12 p
(SC-DR-71-0418) Avail: NTIS

The electric manometer tester was designed to provide a means of leak testing components using the pressure differential method. Cross-checking with a calibrated leak tester has shown the unit to be capable of measuring leak rates of 1 x .0001 cu cm/sec quite accurately; much smaller leaks can be detected and measured, but with some less degree of accuracy. In addition, various materials may be checked for vapor pressure and outgassing effect by using a bell jar or chamber attachment. Author

N72-17430# Sandia Labs., Albuquerque, N.Mex.
TECHNIQUES FOR IMPROVING EFFECTIVE RESPONSE TIMES OF INTRINSIC THERMOCOUPLES
L. W. Bickle and W. R. Keltner Sep. 1971 87 p refs Sponsored by AEC
(SC-RR-71-0146) Avail: NTIS

Intrinsic thermocouples are frequently used to measure rapidly varying surface temperatures on electrically conducting solids. This report: (1) reviews the basic theory of intrinsic thermocouple response; (2) describes an experimental/numerical technique for the transient response of a given thermocouple/substrate combination; and (3) develops and demonstrates the application of numerical techniques for extending the effective response time of intrinsic thermocouples by eliminating the errors introduced by time-lag. Author

N72-17431# Rutherford High Energy Lab., Chilton (England).
SIMPLE IONIZATION MEASURING DEVICE FOR BUBBLE CHAMBER PICTURES
R. Bairstow, A. Brandstetter, and J. H. Hunt Aug. 1971 12 p refs
(RPP/H-81) Avail: AEC Depository Libraries

A small self-contained device for the measurement of ionization in bubble chamber pictures has been developed. A description of the instrument and results of ionization measurements are presented and the possible use of this instrument as an aid for monitoring bubble chamber exposures is discussed. Author (NSA)

N72-17432# Universidad Nacional Autonoma de Mexico, Villa Obregon. Facultad de Ciencias.
MEASUREMENT OF THICKNESSES OF VARIOUS MATERIALS USING Si(Li) AND SURFACE BARRIER DETECTORS Ph.D. Thesis
Victor PerezMedinaOllivary 1971 82 p refs In SPANISH
(NP-18941) Avail: AEC Depository Libraries

The various types of devices used in the measurement of

thickness and uniformity are described. The nuclear detector types and their properties are then discussed. Surface barrier semiconductors and Si(Li) detectors are emphasized. The results obtainable with each type are discussed. The experimental methods used in testing the characteristics of surface barrier and Si(Li) detectors as thickness measuring devices are described. A device for automatically obtaining these measurements and using transistors is discussed. Results obtained for mylar and Al foils are reported. NSA

N72-17433# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
STRIP SEMICONDUCTOR DETECTORS WITH DIGITAL POSITION READOUT
M. A. Fawzi, E. L. Haase, D. P. Saylor, and E. Velton May 1971 13 p refs In GERMAN; ENGLISH summary Presented at the meeting on Nucl. Phys., West Germany, 28 Feb.-5 Mar. 1971
(KFK-1388; Conf-710333-2) Avail: AEC Depository libraries

Solid state detectors with digital position readout were developed to permit the simultaneous measurement of several angles, or the increase of solid angle without increasing the kinematic spread. The counters are large area ion-implanted detectors with a common aluminum contact and a front contact consisting of five or twelve gold strips separated by 0.2 mm. The analog signal is taken in common for all strips from the aluminum contact, and from each strip the position information is picked off via a fast charge sensitive preamplifier. This information is reduced to digital form and stored in discriminator-coincidence-buffer units. At high count rates, these detectors provide immediately available position signals and they permit the elimination of errors and background arising from collimator scattering. Author (NSA)

N72-17434# Kernforschungsanlage, Juelich (West Germany). Zentrallabor fuer Elektronik.
DEFLECTION EQUIPMENT FOR THE PULSED OPERATION OF A LEAD SPECTROMETER
Hannspeter Eulenberg and Paul-Gerhard Manteuffel Jun. 1971 49 p In GERMAN
(JUL-767-ZE) Avail: AEC Depository Libraries

Operation of a lead spectrometer required short deuteron pulses which produced neutrons in a target. A special deflection apparatus was developed which yielded beam pulses of 20-microsec pulse width at intervals from 3 to 27 msec. The pulses were guided across the target within 250 nsec. A special generator was developed for trapezoidal voltages with time-linear deflection characteristics. For this generator, mathematical as well as operational principles are described. The generator was operated from a 120-V source and required only 15 W. NSA

N72-17435# Grenoble Univ. (France). Faculte des Sciences.
CONSTRUCTION AND CALIBRATION OF A HYDROGEN PROPORTIONAL COUNTER FOR ENERGY AND FLUX MEASUREMENTS WITH MONOENERGETIC NEUTRONS BETWEEN 100 AND 500 keV Ph.D. Thesis
Claude Sumeire 1970 199 p refs In FRENCH
(FRNC-TH-43; IDE-4) Avail: AEC Depository Libraries

A cylindrical, hydrogen-filled proportional counter was chosen because the type of measurements usually made with fast neutrons with higher energies (3 and 14 MeV for example) are unsuitable in this energy range owing to low resolution and lack of efficiency. A preliminary study using the classical Townsend expression for the coefficient of electron multiplication of the gas associated with a minimum pressure constraint permitted calculation of the geometric parameters for construction. The apparatus has the following characteristics: a response varying linearly with the neutron energy (spread less than 10 keV), and a capability of yielding accurate values for the neutron dose rate. The concealed alpha source produces a calibration peak from which the neutron energy may be obtained. NSA

N72-17436# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
APPARATUS FRUIT FOR THE CONTINUOUS MEASUREMENT OF CREEP IN URANIUM
Christian Thomas deMontpreville Jun. 1971 15 p In FRENCH
(CEA-N-1426) Avail: AEC Depository Libraries

An apparatus for measuring creep in metals during irradiation is described. The originality of the method by which the deformation is measured is emphasized. NSA

N72-17437# Kernforschungszentrum, Karlsruhe (West Germany). Lab. fuer Elektronik und Messtechnik.
INTEGRATING DIGITAL VOLTMETER AND ANALOG MULTIPLEXER IN CAMAC SYSTEM
B. Deimling, W. Heep, D. Klein, and W. Stiefel May 1971 37 p refs In GERMAN; ENGLISH summary
(NP-19000) Avail: AEC Depository Libraries

An analog multiplexer in connection with a unit to control an integrating digital voltmeter is developed. The control unit fits into the rules proposed for a general CAMAC analog-to-digital converter system. The features of the module and the reasons for using the flying capacitor measuring method are described. Finally, the accuracy of measurement and the methods to avoid errors are discussed. Author (NSA)

N72-17438# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
PASSIVE MAXIMUM TEMPERATURE MEASURING SYSTEM USING FUSIBLE ELEMENTS
A. Grindrod Aug. 1971 8 p ref
(RD/B/N-2057) Avail: AEC Depository Libraries

A maximum-temperature measuring system is described which is based on the well-defined fusion points of a range of pure metals, eutectics and other alloys. The system was designed to measure the maximum temperature in discrete increments where electrical data outlets are impracticable, such as the fuel element housing inside the storage magazine on charge/discharge machinery. Author (NSA)

N72-17439# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
DIGITAL BASE MAGNETOMETRY WITH A HALL EFFECT PROBE
E. P. Balsamo and M. Coli 11 Mar. 1971 27 p refs In ITALIAN
(LNF-71/10) Avail: AEC Depository Libraries

Circuits for digital-base magnetometry with a Hall-effect probe are described. Methods for the thermal stabilization of the probe, excitation of the probe with dc circuits, and extraction of the field and reference signals with ac currents are reported. NSA

N72-17440# Northwestern Univ., Evanston, Ill. Dept. of Physics.
ELECTRON MICROSCOPE CONTAMINATION FORMATION AND CONTRAST Final Report, 1 Sep. 1970 - 31 Aug. 1971
R. L. Hines 1 Sep. 1971 6 p
(Contract AT(11-1)-2110)
(COO-2110-1) Avail: NTIS

An ion pump modification used in this project is described and its operation is discussed. The lateral growth of the edge of a contamination film was measured to determine contamination growth. The contamination rate was observed to vary significantly from sample to sample, so that it was impossible to make meaningful measurements as a function of the experimental conditions. The lowest contamination observed was 1A per minute. In the initial attempt to determine the effect of contamination on high resolution contrast, lattice fringes were observed in potassium chloroplatinate and potassium chloroplatinite using axial illumination. A second attempt utilized the observation of Fresnel fringes around holes in gold crystals about

40A thick. This method was abandoned when no high resolution Fresnel fringes were observed near exact focus. Another experiment was directed toward observing lattice fringes in gold crystals. Tilted illumination was used to eliminate chromatic aberration. No lattice fringes were observed, although the presence of the diffracted beam on the image indicated that the fringes should be present. K.P.D.

N72-17441# Ohio State Univ. Research Foundation, Columbus.
AN INVESTIGATION INTO DYNAMIC AERIAL PHOTOGRAPHIC SYSTEM CALIBRATION Final Technical Report, 14 Nov. 1969 - 19 Mar. 1971
Dean C. Merchant Aug. 1971 68 p refs
(Contract F30602-70-C-0068)
(AD-730335; OSURF-153-FR; RADC-TR-71-174) Avail: NTIS CSCL 14/5

A discussion is presented with the objective first of reviewing the concept of calibration as it pertains to the aerial photographic system. With this as a guide and with the further conditions that calibration procedures should require a minimum modification to the total photographic system yet be a procedure of high reliability, several calibration procedures are suggested. The method of mixed ranges is discussed. Theoretical discussions are also presented concerning mathematical modeling of frame, strip, and panoramic cameras. A procedure for testing the long and short term stability of a photographic system based on a generalized R-factor test is suggested. Recommendations are made concerning the establishment of a demonstration project using the method of mixed ranges. Author (GRA)

N72-17442# Geological Survey, Washington, D.C. Water Resources Div.
REMOTE SENSING BIBLIOGRAPHY FOR EARTH RESOURCES, 1969
J. P. Glasby and Dorothy G. Lowe Oct. 1970 198 p refs
(PB-202726; USGS-WD-71-001) Avail: NTIS CSCL 08F

A compilation of 612 reference citations from 1969 literature is given in this bibliography, the fourth in a series of bibliographies on remote sensing. Technical material concerning methodology and applications for earth resources studies is cited, stressing advancements in airborne and earth satellite techniques. The citations cover nine subject categories and are arranged alphabetically by title under each category and in consecutive numerical order. Each item includes title, bibliographic citation, and a set of indexing descriptors. Indexes with applicable citation numbers are provided for author, corporate author, and subject terms. The cumulative subject term index at the end of the volume provides the necessary access to the key-word descriptors. The 70 journals searched for reference items are listed. Author (GRA)

N72-17443# Cornell Univ., Ithaca, N.Y. Materials Science Center.
SUPERCONDUCTING QUANTUM MAGNETOMETERS
Watt W. Webb 16 Nov. 1971 46 p refs
(Contract N00014-67-A-0077-0016)
(AD-732797; MSC-1694; TR-7) Avail: NTIS CSCL 14/2

Magnetometers of remarkable sensitivity using superconducting quantum flux detectors have recently become available. The mechanisms of operation and the present capabilities of these magnetometers and related instruments are described in this review from an elementary viewpoint. Author (GRA)

N72-17444# Army Materials and Mechanics Research Center, Watertown, Mass. Theoretical and Applied Mechanics Research Lab.
MODIFICATIONS TO AN AXIAL TENSION TESTER FOR BRITTLE MATERIALS
George W. Driscoll and Francis I. Baratta Aug. 1971 29 p refs
(AD-732393; AMMRC-PTR-71-3) Avail: NTIS CSCL 14/2

In the conclusions of an earlier report, the authors expressed their intent to further develop a system for the tension testing of brittle materials. The report investigates the steps taken to accomplish this objective. A redesign of the original device has produced a more compact, easier to use system while still maintaining all the favorable features. This device effectively minimizes the parasitic bending stress normally associated with the conventional tension test. Additionally, the specimen designed for use in the original device was redesigned to reduce the overall size and to incorporate a constant diameter gage section. A plastic material (Hysol cp5-4290), which was readily available and which exhibits the brittle characteristics desired, was chosen as the specimen material to be used in the test program conducted to proof test the device and specimen design. Tests were also conducted to determine the load-error effect of the O-rings with the intent of establishing a load calibration procedure. Author (GRA)

N72-17445# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TEST AND EVALUATION OF A DAYTIME COCKPIT FOG SIMULATOR Final Report, Apr. 1969 - May 1971
Morris Ritter Nov. 1971 37 p refs
(FAA Proj. 073-323-04(X); FAA Proj. 430-301-09(X))
(AD-732621; FAA-NA-71-44; FAA-RD-71-82) Avail: NTIS CSCL 14/2

An evaluation was conducted at the National Aviation Facilities Experimental Center (NAFEC), Atlantic City, N. J., to determine the suitability of Daytime Cockpit Fog Simulator to accurately and realistically simulate category 2 and category 3 weather conditions to the pilot during flight approaches. Thirteen pilots, using a DC-7 aircraft, participated in the program. The fog simulator was evaluated during atmospheric meteorological visibilities ranging from 1 1/2 to over 12 miles. Technical data, as well as completed pilot questionnaires, comprised the data analyzed. Although the simulator shows merit insofar as projecting realism, a redesign of the unit is necessary to correct deficiencies in various optical, electronic, and mechanical areas. Author

N72-17446# Central Dockyard Lab., Portsmouth (England).
CDL CORROSION METER
1971 6 p refs
(AD-732525; CDL-TM-HKU/2; NSTIC-31331) Avail: NTIS CSCL 14/2

The C.D.L. corrosion meter applies a slow cycle square wave current pulse between test and auxiliary electrodes and measuring the resultant potential shift of the test electrode with reference to a standard electrode. GRA

N72-17447# Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
TURBIDITY INSTRUMENTATION. A FIBER-OPTIC SYSTEM FOR MEASURING SEDIMENT CONCENTRATION BY OPTICAL FOURIER TRANSFORMATION
Albert McSweeney Jul. 1971 29 p refs
(OWRR Proj. A-027-GS(1))
(PB-202985; ERC-0471) Avail: NTIS CSCL 14B

Optical transformation techniques using a laser for illumination were investigated to measure sediment concentration in a water sample. An optical Fourier transformation system was set up with a bundle of fiber-optic light-pipes connected to an array of photo detectors for analyzing the transform of samples of known particle size distribution. Two of seven information channels of the fiber-optic bundle were used as a test. Intensity measurements from the test of two known monodisperse samples were used to generate a matrix of weight functions. The matrix was used to transform the measured intensity from a mixture containing two particle sizes which were different from the sizes used to determine the matrix. Results show that the system could not distinguish between 160 and 187 micrometer diameter particle but discriminated well between 276 and 321 micrometer diameter particles. Both size resolution and accuracy are expected to improve as more fiber-optic channels are used. Author (GRA)

N72-17448# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
RADIATION SAFETY IN X-RAY DIFFRACTION AND SPECTROSCOPY
Thomas M. Moore, Walter E. Gundaker, and John W. Thomas Sep. 1971 249 p refs Conf. held at Philadelphia, Pa., 6-7 Jan. 1970
(PB-203577; BRH/DEP-72-3) Avail: NTIS GPO HC $2.00 as HE20.4110:73-3 CSCL 14B

A conference on radiation safety in X-ray diffraction and spectroscopy was held to fill the need for improved communications between users of X-ray diffraction and spectroscopy equipment, health physicists, and governmental agencies with regulatory responsibilities. Radiation safety in the use of the equipment was discussed from the viewpoints of the experimentalist and other user-oriented personnel, individuals concerned primarily with radiation safety, and agencies responsible for developing and enforcing guides, standards, and regulations. This report contains the conference proceedings; it includes both the papers presented and the discussions held at the conference.
Author (GRA)

N72-17449# Cornell Univ., Ithaca, N.Y. Materials Science Center.
MAGNETOMETERS AND INTERFERENCE DEVICES
Watt W. Webb 1 Oct. 1971 27 p refs Submitted for publication
(Contract N00014-67-A-0077-0016; NR Proj. 421)
(AD-730768; MSC-1652; TR-6) Avail: NTIS CSCL 14/2

The quantum superconductivity of low inductance rings interrupted by superconducting weak links provides the basis for magnetic flux sensors that are useful for sensitive measurements of magnetic flux and fields and for extremely small voltages in low impedance circuits. The theoretical basis and mechanisms, and the current state of the art in design and capabilities of these devices is described.
Author (GRA)

N72-17880*# Translation Consultants, Ltd., Arlington, Va.
DETERMINATION OF CERTAIN INSTRUMENTAL CHARACTERISTICS OF THE ZTL-180 ZENITH-TELESCOPE OF THE POLTAVA OBSERVATORY
N. A. Popov, N. I. Panchenko, and A. T. Tsapova *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 90-100 refs (See N72-17874 08-30)
Avail: NTIS CSCL 14B

N72-17882*# Translation Consultants, Ltd., Arlington, Va.
PHOTOEXPOSURE METER FOR PHOTOGRAPHIC RECORDING OF CIRCLE READINGS
A. M. Stafeyev and I. N. Nabokov *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 111-113 (See N72-17874 08-30)
Avail: NTIS CSCL 14E

N72-17884*# Translation Consultants, Ltd., Arlington, Va.
CHROMATIC CURVE OF THE OBJECTIVE OF THE AVR-2
B. F. Sincheskul and V. N. Sincheskul *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 119-127 refs (See N72-17874 08-30)
Avail: NTIS CSCL 14B

N72-17620*# Advanced Technology Center, Inc., Dallas, Tex.
A REAL TIME SPECTRUM TO DOSE CONVERSION SYSTEM
B. J. Farmer, J. H. Johnson, and R. G. Bagwell *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 142-148 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

N72-17680*# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
A PORTABLE ABSORBED DOSE MEASURING INSTRUMENT WITH GAMMA DISCRIMINATION
W. M. Quam and W. I. Wilde *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 609-613 (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

N72-17681*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
A COMPTON SCATTER ATTENUATION GAMMA RAY SPECTROMETER
W. E. Austin *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 614-617 refs (See N72-17601 08-22)
(Contract NAS8-25617)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

N72-17698*# Teledyne Isotopes, Westwood, N.J.
A HIGH RESOLUTION SEMICONDUCTOR DETECTOR FOR APPLICATIONS IN SPACE
Peter Alexander and Herman Shulman *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 723-728 refs (See N72-17601 08-22)
(Contracts NAS1-6654; DASA01-70-C-0040)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

N72-17699*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIATION EFFECTS ON SCIENCE INSTRUMENTS IN GRAND TOUR TYPE MISSIONS
Richard H. Parker *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 729-734 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

N72-17700*# Aerojet Electrosystems Co., Azusa, Calif.
RADIATION NOISE IN A HIGH SENSITIVITY STAR SENSOR
J. B. Parkinson and E. Gordon *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 735-743 refs Sponsored by SAMSO (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

N72-17719*# Atomic Weapons Research Establishment, Aldermaston (England).
EVALUATION OF 2 POSSIBLE FURTHER DEVELOPMENTS OF THE UK IN-FLIGHT RADIATION WARNING METER FOR SSTS
I. J. Wilson and R. C. Eustace *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 874-883 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

N72-17722*# Air Force Weapons Lab., Kirtland AFB, N.Mex.
DOSE AND LINEAR ENERGY TRANSFER SPECTRAL MEASUREMENTS FOR THE SUPERSONIC TRANSPORT PROGRAM
Richard B. Philbrick *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 902-907 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

N72-17727*# Air Force Academy, Colo.
ADVANCED DOSIMETRY SYSTEMS FOR THE SPACE TRANSPORT AND SPACE STATION

Louis F. Wailly, Marion F. Schneider (AFWL), and Benton C. Clark (Martin Marietta Corp.) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 944-957 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

N72-17728*# Air Force Weapons Lab., Kirtland AFB, N.Mex. Technology Div.
EXPERIMENTAL ACTIVE AND PASSIVE DOSIMETRY SYSTEMS FOR THE NASA SKYLAB PROGRAM
Marion F. Schneider, Joseph F. Janni, and Glenn C. Ainsworth *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 958-973 refs *(See N72-17601 08-22)*
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

N72-17862*# Translation Consultants, Ltd., Arlington, Va.
THE NOBLE GAS SCINTILLATION MECHANISM
B. A. Dolgoshein and B. U. Rodionov *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 170-198 refs (See N72-17850 08-29)
Avail: NTIS CSCL 14B

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication; friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N72-17450* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LOW ONSET RATE ENERGY ABSORBER Patent
William H. Keathley and Clarence J. Wesselski, inventors (to NASA) Issued 7 Sep. 1971 5 p Field 31 Mar. 1970
(NASA-Case-MSC-12279; US-Patent-3,603,433;
US-Patent-Appl-SN-24154; US-Patent-Class-188-1C;
US-Patent-Class-188-129) Avail: US Patent Office CSCL 13I

A low onset rate energy absorber for decelerating a moving mass at a controlled rate without amplification of loads through the system is reported. The device is a strut assembly for the crew couch of the Apollo command module. It includes a rod of substantially uniform diameter having one end arranged to receive the force of the moving mass in a generally axial direction. Washers are mounted on the rod in spaced-apart and force-fitting relationship. It includes thrust means arranged to receive the force in the generally axial direction and for initially contacting and axially stroking one of the washers and sequentially stroking others of the washers along the rod in response to a force applied in the axial direction. The energy absorber uses friction as a direct means of converting the energy to heat.
Official Gazette of the U.S. Patent Office

N72-17451* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AIR BEARING Patent
James W. Maddox and Frank Wolf, T., inventor (to NASA) Issued 5 Oct. 1971 5 p Filed 17 Jun. 1970
(NASA-Case-WLP-10002; US-Patent-3,610,365;
US-Patent-Appl-SN-47062; US-Patent-Class-180-125;
US-Patent-Class-180-127; US-Patent-Class-308-5;
US-Patent-Class-308-9; US-Patent-Class-308-DIG.1) Avail: US Patent Office CSCL 13I

An air bearing is described for use in an exterior environment to facilitate movement of a heavy load in a horizontal plane. It includes a flexible peripheral seal to direct the flow of pressurized air toward a metal plate surface and toward a central air outlet, and a floating wiper circumferentially disposed about the air bearing body to keep sand and dirt off the bearing lifting area.
Offical Gazette of the U.S. Patent Office

N72-17452* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXTENSOMETER FRAME Patent
Robert M. Baucom and George J. Heimerl, inventors (to NASA) *Issued 28 Sep. 1971 4 p Filed 23 Dec. 1969 Supersedes* N70-36017 (08 - 19, p 3550)
(NASA-Case-XLA-10322; US-Patent-3,608,365;
US-Patent-Appl-SN-887699; US-Patent-Class-73-88.5R) Avail: US Patent Office CSCL 14B

A transducer frame is described for accomodating a displacement transformer for continuous monitoring of a specimen sample. The movable and stationary parts of the frame are maintained in continuous tension, with friction and binding of the parts being avoided during extension or contraction testing. The frame structure allows the displacement transformer to operate independent of the clamping pressure applied to the tested specimen.
D.L.G.

N72-17453* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VALVING DEVICE FOR AUTOMATIC REFILLING IN CRYOGENIC LIQUID SYSTEMS Patent
Joe Liberotti, inventor (to NASA) Issued 20 Sep. 1971 3 p
Filed 19 Mar. 1970 Supersedes N70-35190 (08 - 19, p 3545)
Sponsored by NASA
(NASA-Case-NPO-11177; US-Patent-3,605,424;
US-Patent-Appl-SN-20960; US-Patent-Class-6251) Avail: US Patent Office CSCL 13K

A valving device especially suited for use in the refilling system of cryogenic liquids is described. A mercury column, the length of which is varied by expansion and contraction of methane within the mercury submerged bell and commuting fluid level probe, is employed to valve the vent of a closed cryogenic liquid supply vessel and cause cryogenic liquid to be displaced into a cryogenic liquid consumption device.
Official Gazette of the U.S. Patent Office

N72-17454* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPANSIBLE SUPPORT MEANS Patent
Robert M. Norman and Gerrit Steenhagen, inventors (to NASA) Issued 21 Sep. 1971 3 p Filed 6 Oct. 1969 Supersedes N70-22163 (08 - 09, p 1641) Sponsored by NASA
(NASA-Case-NPO-11059; US-Patent-3,606,979;
US-Patent-Appl-SN-864020; US-Patent-Class-248-14) Avail: US Patent Office CSCL 13I

A base support for providing an expansible and contractible coupling between two members is described, having a pair of laterally movable mounts and a rigid mount, spaced around a support ring comprising the first member. Each movable mount includes a four-bar linkage arrangement in which the top horizontal bar is connected to the supported second member. The rigid mount is also connected to the supported second member, with the four-bar linkage arrangements being oriented in such a manner that the axes of their respective lateral movements intersect the rigid mount. As a result, the movable mounts compensate for the thermal contraction and expansion of either of the members, while still permitting the second member to be rigidly secured to the support ring.
Official Gazette of the U.S. Patent Office

N72-17455* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BREAKAWAY CONNECTOR Patent
Leonard Katzin, inventor (to NASA) Issued 5 Oct. 1971 7 p Filed 29 Feb. 1970 Supersedes N70-41979 (08 - 24, p 4516)
Sponsored by NASA
(NASA-Case-NPO-11140; US-Patent-3,611,274;
US-Patent-Appl-SN-15019; US-Patent-Class-339-278M;
US-Patent-Class-89-1.811; US-Patent-Class-174-84;
US-Patent-Class-200-64; US-Patent-Class-339-46;

US-Patent-Class-339-176M) Avail: US Patent Office CSCL 09A

A breakaway connector is described which is particularly suited for use in connecting the ends of multiwire cables such as umbilical type cables. The device is characterized by a separable pair of juxtaposed connector units, each including a number of laterally space electrical terminals coupled with adjacent ends of selected circuit leads. Each of the flexible leads is of a unique length so that as the units are separated, the leads are tensioned sequentially with a sufficient stress to achieve a rupture of the lead. Official Gazette of the U.S. Patent Office

N72-17456*# Arizona Univ., Tucson. Coll. of Engineering.
GENERATION OF FINITE LIFE DISTRIBUTIONAL GOODMAN DIAGRAMS FOR RELIABILITY PREDICTION
Dimitri Kececioglu and William Neil Guerrieri 31 Aug. 1971 258 p refs
(Grant NGR-03-002-044)
(NASA-CR-120813) Avail: NTIS CSCL 14D

The methodology of developing finite life distributional Goodman diagrams and surfaces is described for presenting allowable combinations of alternating stress and mean stress to the design engineer. The combined stress condition is that of an alternating bending stress and a constant shear stress. The finite life Goodman diagrams and surfaces are created from strength distributions developed at various ratios of alternating to mean stress at particular cycle life values. The conclusions indicate that the Von Mises-Hencky ellipse, for cycle life values above 1000 cycles, is an adequate model of the finite life Goodman diagram. In addition, suggestions are made which reduce the number of experimental data points required in a fatigue data acquisition program. Author

N72-17457*# General Electric Co., Cincinnati, Ohio.
FABRICATION AND TEST OF A SPACE POWER BOILER FEED ELECTROMAGNETIC PUMP. PART 2: TEST FACILITY AND PERFORMANCE TEST
A. H. Powell, J. C. Amos, C. L. Ehde, and J. W. Gahan Washington Feb. 1972 79 p
(Contract NAS3-9422)
(NASA-CR-1950; GESP-459-Pt-2) Avail: NTIS CSCL 13K

A three-phase helical induction electromagnetic pump, designed for the boiler-feed pump of a potassium Rankine-cycle space power system, was built and tested. The pump was tested over a range of potassium temperatures from 900 to 1400 F, flow rates from 0.75 to 4.85 lb/sec, developed pressures up to 340 psi, net positive suction heads (NPSH) from 1 to 22 psi, and NaK coolant temperatures from 800 to 950 F. The maximum efficiency at the pump design point of 3.25 lb/sec flow rate, 240 psi developed pressure, 1000 F potassium inlet temperature, and 800 F NaK coolant temperature was 16.3 percent. The tests also showed successful operation of the pump at an NPSH as low as 1.5 psi without cavitating. Author

N72-17458# Bendix Corp., Kansas City, Mo.
SOLDER SPLATTER CAUSED BY OUTGASSING HOLES IN PRINTED WIRING BOARDS
B. T. Lampe, M. E. Evans, C. L. Long, and R. B. Snelt May 1971 38 p
(Contract AT(29-1)-613)
(BDX-613-505) Avail: NTIS

A serious foreign material problem on the Lambda assembly was resolved by a change in the fabrication process for the printed wiring board. Foreign material in the form of solder splatter was found to originate from outgassing plated through-holes during soldering. Voids in the copper through-hole plating allowed molten solder to penetrate into the epoxy-glass base material of the board and decompose the epoxy. The gas evolved caused the solder joints to bubble and expel small solder balls over the surface of the board. The voids in the copper plating were found to be a direct result of the degradation of the as-drilled hole during one of the initial plating processes. Fluoboric acid in the plating bath attacked the exposed glass fibers along the sidewall of the drilled hole producing large cavities in the epoxy. Changing to a plating process which did not degrade the holes solved the problem. Author

N72-17459# California Univ., Livermore. Lawrence Radiation Lab.
SHOCK ISOLATION SYSTEM FOR 22 FEET OF VERTICAL GROUND MOTION
E. C. Jackson, A. B. Miller, and D. L. Bernreuter 1 Oct. 1971 8 p ref Presented at the 42d Shock and Vibration Symp., Key West, Fla., 2-4 Nov. 1971
(UCRL-73469; CONF-711110-1) Avail: NTIS

Shock isolation of fragile equipment from severe ground motion induced by underground nuclear detonations requires special techniques for inexpensive, reliable performance. Two shock-mitigation systems that have been used successfully for the past several years are described. These systems have allowed equipment to be located closer to the explosive source, resulting in considerable savings in diagnostic cable costs. A new system was designed for even more severe ground motion. The new design, the instrumented testing program, and test results are discussed. Author (NSA)

N72-17460# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
REMOTE INSPECTION OF WELDED JOINTS
R. W. McClung Sep. 1971 16 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3561) Avail: NTIS

Maintenance and repair of reactor components by remote welding requires the development of adequate nondestructive examination techniques to assure the integrity of the weld. High temperature and radiation levels necessitate remote inspections. Recommended developments include improved closed circuit television for visual examination, evaluation of new high temperature penetrants, study of neutron radiography, improved transducers for ultrasonics, and application of acoustic emission and eddy currents. Sophisticated mechanical positioning, manipulation, and scanning equipment are required for most of the techniques. Author (NSA)

N72-17461# Oak Ridge National Lab., Tenn.
TUBING FABRICATION PARAMETERS AND THEIR APPLICATION TO TEXTURE CONTROL IN ZIRCALOY TUBING
D. O. Hobson Oct. 1971 43 p
(Contract W-7405-eng-26)
(ORNL-TM-3500) Avail: NTIS

Tubing fabrication involves combinations of strains imposed upon the material to effect required dimensional changes. These strains were analyzed from the standpoint of type of fabrication operation and have produced a graphical method for plotting fabrication paths. Such a method is applicable to operations, such as tube reducing, in which the inside surface dimension of the tubing is controlled throughout the fabrication step. Other operations, such as rod-mandrel drawing, required additional analysis of the true strains involved. Texture formation in Zircaloy tubing is dependent upon the ratio of true wall thickness strain to true circumferential strain at any point in the tube wall. The texture formation was characterized with fabrication parameters and showed how texture control can be achieved with all common fabrication processes. Author (NSA)

N72-17462# Bettis Atomic Power Lab., Pittsburgh, Pa.
BIBLIOGRAPHY ON ELECTRICAL DISCHARGE MACHINING AND ELECTROCHEMICAL MACHINING
W. C. Wahl and Linda L. Tafel Sep. 1971 215 p refs
(Contract AT(11-1)-Gen-14)
(WAPD-331) Avail: NTIS

A bibliography containing over 1000 references to publications published from 1950 to 1970 on electrical discharge machining and electrochemical machining is presented. The

indexes and journals reviewed as bibliographic source material are listed. Author and subject indexes are included. NSA

N72-17463# Sandia Labs., Albuquerque, N.Mex.
DEVELOPMENT OF PROCESSES FOR THE HOT PRESSING OF SILICON-GERMANIUM THERMOELECTRIC ELEMENTS
R. H. Dungan and J. C. Smith Aug. 1971 30 p refs
Sponsored by AEC
(SC-DR-71-0438) Avail: NTIS

Procedures for hot pressing n- and p-type 80/20 atomic percent silicon-germanium alloys are described. The procedures result in specimens of about 99 percent theoretical density with electrical properties which are uniform throughout the specimen to within + or - 5 percent. The selected method involves vacuum hot pressing chill cast powder in molybdenum alloy dies at a pressure of 25,000 psi, with temperatures ranging from 1275 to 1300 C and soak times ranging from 5 to 30 minutes. The specimens are hot ejected into a helium atmosphere. Processes for preparing hot pressed silicon-germanium alloys directly from elemental powders are also discussed, but they were judged to be less satisfactory than those using chill-cast powder as the starting material. Author

N72-17464# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Construction Dept.
SOME REMARKS CONCERNING ZIRCONIUM ALLOY WELDING
J. Sika 1971 20 p refs
(ZJE-110) Avail: AEC Depository Libraries

Aspects of zirconium alloy welding directed especially toward shielded welding using the TIG-method or electron beam welding are examined. Experimental welding results are given which have been achieved first on substitute materials and afterwards mainly on the C2M zirconium alloy up to a thickness of 1 mm. A brief description of the welding equipment, protection chamber with preliminary vacuum treatment, the ES-2 electron welding machine is given which indicates the possibilities of welding fuel element cans from zirconium alloy.
Author (NSA)

N72-17465# Los Alamos Scientific Lab., N.Mex.
HIGH ENERGY RATE FORMING OF REFRACTORY METALS
Donald J. Sandstrom and Dale S. Fisher Sep. 1971 14 p refs
(Contract W-7405-eng-36)
(LA-4752; R1823) Avail: NTIS

A variety of techniques for forming refractory metals, high temperature alloys, and cermets are being investigated. Pneumatic mechanical forming, especially extrusion, has been used to produce a variety of shapes from refractory metal alloys and cermets. Using a conventional filled billet extrusion technique, sound, high density W + U02 and Mo + U2O tubular products have been produced. Considerable attention has been given to the design of tools used in high temperature extrusion processes and operational experience has been employed in the redesign of tools to increase their life. Author (NSA)

N72-17466# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME QUESTIONS OF VACUUM TECHNOLOGY DURING THE DEPOSITION OF THIN FILMS
B. S. Danilin and V. E. Minaichev 17 Aug. 1971 20 p refs
Transl. into ENGLISH from the publ. "Fizika Metallicheskikh Plenok" Kiev, Naukova Dumka, 1969 p 77-87
(AD-731900; FTD-MT-24-121-71) Avail: NTIS CSCL 13/8

The structure and properties of thin films obtained by thermal vaporization in a vacuum are determined to a considerable degree by the conditions of condensation and depend on temperature of vaporization, rate of condensation, and angle of incidence of deposited substance on the base layer; nature of the base layer, its degree of purity, and microrelief of the surface; the degree of evacuation and the composition of residual gases during condensation. The parameters of the above categories are discussed briefly in this article. The conclusion is that as the change in the properties of films is influenced decisively in many cases not by the absolute magnitude of the vacuum, but by the magnitude of partial pressures of definite gases and vapors, their removal from the working volume by selective evacuation is a simpler and more real solution to the problem of obtaining pure films than the superhigh vacuum.
Author (GRA)

N72-17467# British Steel Corp., London (England). Metallurgy Group.
CONTROLLED ROLLING OF CARBON AND LOW ALLOY STEELS
D. Dulieu, D. J. Latham, J. W. Bannister, and S. Gibson 1971 20 p refs
(PB-202842; BISRA-MG/INT/73/70) Avail: NTIS CSCL 13H

Simplified thermomechanical treatments were carried out on carbon and low alloy steels by bar rolling at temperatures close to or below Ac sub 3 followed by direct quenching. Strength was usually raised by these techniques compared with conventional treatments. The magnitude of the strength increase depended on composition and was particularly marked for lean alloy steels. Significant improvements in impact resistance were obtained for the higher alloyed steels. The influence of prior austenite grain size and shape, texture and the contribution of inclusion fibring to the property response is discussed.
Author (GRA)

N72-17468# Harry Diamond Labs., Washington, D.C.
FIBER OPTIC SEALS: A PORTABLE SYSTEM FOR FIELD USE IN INTERNATIONAL SAFEGUARDS AND ARMS CONTROL APPLICATIONS
R. R. Ulrich Oct. 1971 27 p ref
(DA Proj. 1W2-62301-A-20700; HDL Proj. SYS43)
(AD-732851; HDL-TR-1571) Avail: NTIS CSCL 11/1

A prototype model of a portable safing system that uses fiber optic seals and assembles, photographs and identifies them in the field has been designed and constructed for the U. S. Arms Control and Disarmament Agency (ACDA). The system is intended for test and evaluation to further develop the procedures and practices for using fiber optic seals and to determine design criteria for improved equipment and systems for operational use.
GRA

N72-17469# American Hydrotherm Corp., New York.
PERFORMANCE TEST OF HIGH TEMPERATURE WATER JET COMPRESSOR OPERATING IN HIGH TEMPERATURE RANGE Final Report
L. Maifitani and A. Frenzel May 1971 54 p ref
(Contract DI-14-01-0001-2165)
(PB-202753; OSW-PR-664) Avail: NTIS; SOD $0.50 as 2491-1152, IL88:664 CSCL 07A

Tests on a high temperature water jet vapor compressor is described at high discharge vapor pressures (corresponding to 280F) to compare performance with that observed previously with lower discharge pressures (corresponding to 240F). The performance ratio was 0.0238 when the HTW was at 1223 psia and 570F. The high pressure jet performed best with a 19F rise, and performed well up to 23F rise, indicating that the jet may be applied in multistage desalination systems with up to four stages. In application to desalination systems, the HTW jet requires only 40 Btu/lb of product when operating with a 20F rise over four-effect evaporator with a 10:1 feed train.
Author (GRA)

N72-17637*# Aerojet Nuclear Systems Co., Sacramento, Calif.
TELEOPERATORS FOR REMOTE OPERATIONS IN SPACE
L. E. Little and F. L. DiLorenzo *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 277-279 Sponsored by AEC and NASA (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 13I

N72-17638*# General Electric Co., Philadelphia, Pa.
TELEOPERATOR SYSTEMS FOR MANNED SPACE MISSIONS
Alfred Interian *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 280-290 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 13I

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N72-17470# National Bureau of Standards, Boulder, Colo.
DAMAGE IN LASER MATERIALS: 1971
Alexander J. Glass, ed. (Wayne State Univ., Detroit, Mich.) and Arthur H. Guenther, ed. (AFWL, Kirtland AFB, N. Mex.) Nov. 1971 185 p refs Symp. held at Boulder, Colo., 19-20 May 1971; Sponsored by Am. Soc. for Testing and Mater.
(NBS-SP-356; LC-77-181048) Avail: SOD $1.50 as C13.10:356

The proceedings of a symposium on damage in laser materials are presented. Subjects discussed are: (1) diagnostic development, (2) damage testing and assessment, (3) damage theory, (4) physical characteristics of optical media of importance in controlling damage, and (5) damage to thin film coatings, and (6) damage to nonlinear optical materials. For individual titles, see N72-17471 through N72-17488.

N72-17471# National Bureau of Standards, Boulder, Colo.
SUMMARY AND CONCLUSIONS
A. J. Glass and A. H. Guenther *In its* Damage in Laser Mater. Nov. 1971 9 p refs (See N72-17470 08-16)
Avail: SOD $1.50 as C13.10:356

The proceedings of a seminar on damage to laser materials are summarized. Subjects presented at the symposium were laser induced damage to glass, crystalline materials, nonlinear optical materials, thin film dielectric coatings, and mirrors. Also discussed were the processes of plasma formation at dielectric surfaces and the role played by self-focusing in bulk damage to solids. The principal conclusions reached at the seminar and the content of each presentation are included. Author

N72-17472# JENAER Glaswerk Schott and Gen., Mainz (West Germany).
DAMAGE BY LASER RADIATION OF IMPROVED NEODYMIUM-ACTIVATED LASER GLASS, COLORED GLASSES AND OPTICAL GLASSES
N. Neuroth, R. Hasse, and A. Knecht *In* NBS Damage in Laser Mater. Nov. 1971 p 3-14 refs (See N72-17470 08-16)
Avail: SOD $1.50 as C13.10:356

The optical loss of Nd-activated laser glass (absorption 0.15%/cm at 1060 nm) has been reduced resulting in a substantially increased operating efficiency. Recent materials have given induced emission efficiencies approximately triple the results obtained with previously produced glasses. The damage (surface) threshold is reported to be 1.3 x 10 to the 9th power watts per square centimeter for active (lasing) operation. When irradiated passively (from external source), measurements have shown the damage (bulk) limit to be 2.5 x 10 to the 9th power watts per square centimeter. Metallic inclusions are eliminated by the melting process, which does not employ platinum. Since optical or colored glasses are often used in laser applications, studies have been made of damage processes and limits of these materials also. A number of different glass types were irradiated with 0.7 millisecond laser pulses, and the energy level at which surface damage begins was determined (preliminary data). Among the colored glasses, the damage threshold is primarily a function of the material absorption at the wavelength of the laser beam. Author

N72-17473# Owens-Illinois, Inc., Toledo, Ohio.
LASER GLASS DAMAGE THRESHOLD STUDIES AT OWENS-ILLINOIS
N. L. Boling and R. W. Beck *In* NBS Damage in Laser Mater. Nov. 1971 p 15-23 Sponsored by ARPA (See N72-17470 08-16)
Avail: SOD $1.50 as C13.10:356

Damage induced in laser glass materials exposed to high intensity laser pulses is discussed. Mechanisms responsible for glass damage are investigated. A high intensity, neodymium glass, oscillator-amplifier system is used to induce surface damage in samples of laser glass and a ruby laser is used to record high speed holograms of the damage interactions. The technique allows an investigation of the plasma produced at the sample surface and also detects the creation of shock waves within the sample. Author

N72-17474# Colorado State Univ., Fort Collins.
INVESTIGATION OF CUMULATIVE EFFECTS IN MICROSCOPICALLY DAMAGED QUARTZ c18
David F. Edwards, C. Y. She, and V. G. Draggoo *In* NBS Damage in Laser Mater. Nov. 1971 p 24-30 refs Sponsored in part by AFCRL (See N72-17470 08-16)
Avail: SOD $1.50 as C13.10:356

Measurements have been made of the change in the forward scattering component relative to the incident radiation of the multimode laser. The effects of microscopic damage and the evolution of microscopic into catastrophic damage in crystalline quartz. The catastrophic damage threshold is shown to be dependent on the propagation and polarization direction for the multimode laser. A penomenological model is developed that consistently describes the experimental observations. Author

N72-17475# Michigan State Univ., East Lansing. Dept. of Chemistry.
PLASMA FORMATION UPON LASER IRRADIATION OF TRANSPARENT DIELECTRIC MATERIALS BELOW THE DAMAGE THRESHOLD c25
B. E. Henderson, R. R. Getty, G. E. Leroi, and D. L. Rousseau (Bell Telephone Labs., Inc., Murray Hill, N. J.) *In* NBS Damage in Laser Mater. Nov. 1971 p 31-36 refs Sponsored in part by ONR (See N72-17470 08-16)
Avail: SOD $1.50 as C13.10:356

The interaction of high power laser (ruby or neodymium-glass) radiation with ostensibly transparent materials is discussed. Even at power levels below the threshold for either surface or internal damage, the emission of both positive and negative ions and of high energy radiation has been detected. Both linear and non-linear absorption mechanisms have been proposed, and plasma initiation has been attributed to such factors as surface contaminants, surface defects, internal impurities, and free carrier absorption. The experimental procedures, results, and interpretations of several of these investigations are reviewed. Although the residual ion emission can be greatly reduced by careful pre-cleaning and handling procedures, it can not be eliminated entirely. The ramifications of this conclusion must be considered in the analysis of experiments in which damage is observed. Author

N72-17476# Kent State Univ., Ohio. Dept. of Physics.
DIFFUSION EFFECTS IN HIGH POWER LASER DAMAGE
Wilbur Franklin *In* NBS Damage in Laser Mater. Nov. 1971 p 37-43 refs Sponsored by NSF (See N72-17470 08-16)
Avail: SOD $1.50 as C13.10:356

The theory of diffusion in laser solids in the presence of high optical power densities is presented. It is shown that a small number of laser-excited phonons having the proper wavevector for diffusion, can affect the diffusivity significantly. The effects of a thermal gradient and of pressure are evaluated quantitatively under certain conditions. In addition, since the activation energy for defect migration can be substantially reduced upon excitation of the localized ground state electron, diffusion effects are shown to be possible under typical laser damage conditions. Author

N72-17477# Hughes Research Labs., Malibu, Calif.
TIME EVOLUTION OF DAMAGE TRACKS IN SAPPHIRE AND RUBY **c18**
Concetto R. Giuliano *In* NBS Damage in Laser Mater. Nov. 1971 p 44-50 refs (See N72-17470 08-16)
(ARPA Order 1434)
Avail: SOD $1.50 as C13.10:356

A fast streaking camera has been used to observe the time-evolution of bulk damage filaments in sapphire and ruby on a nanosecond time scale. Externally focused light from a mode controlled ruby laser and amplifier was used to induce damage in the samples studied. Either side-scattered light at 6943 Angstroms or blue-green light from the self-luminous damage sites was detected by the streaking camera. It was found that damage first occurs at or near the natural focus of the lens, and that the damage track grows in an upstream direction toward the laser. The relationship between the location of the damage at a given instant and the corresponding instantaneous laser power is discussed. Author

N72-17478# California Univ., Los Angeles.
THEORY OF SELF-FOCUSING FOR FAST NONLINEAR RESPONSE **c19**
J. Marburger *In* NBS Damage in Laser Mater. Nov. 1971 p 51-60 refs (See N72-17470 08-16)
(Contract F44620-71-C-0067)
Avail: SOD $1.50 as C13.10:356

Numerical solutions of the nonlinear wave equation lead to essentially exact formulas describing the behavior of a self-focusing beam up to the first self-focus, if the nonlinear response is instantaneous. The relation of these formulas to similar ones obtained by ray tracing or quasi-optics, and the influence of terms in the vector wave equation usually ignored in numerical studies are discussed. Formulas for the on-axis intensity and position of the first focal point, for focussed and unfocussed guassian beams are presented. The effect of aberration and deviations from gaussian profile are described. The time evolution of damage tracks in solids, and how the formulas may be modified phenomenologically to account for retarded response of the nonlinear index are examined. The possible influence on damage tracks of the self-focusing phenomena beyond the first self focus is also discussed. Author

N72-17479# Perkin-Elmer Corp., Wilton, Conn. Research Dept.
ELECTROSTRICTIVE LASER BEAM FOCUSING IN GLASS AND SMALL-SCALE TRACK FORMATION
Edwin L. Kerr *In* NBS Damage in Laser Mater. Nov. 1971 p 61-75 refs (See N72-17470 08-16)
(Contract F19628-69-C-0220)
Avail: SOD $1.50 as C13.10:356

Transient and steady-state approximate solutions of the sound and light wave equations are discussed. Calculated beam trapping thresholds are compared with experimental track formation thresholds. An expression for the parameter RHO sub zero times delta n divided by delta RHO in terms of the photoelastic constants is described. Beam focusing is described by a newly derived small-scale beam tracing equation. This equation includes approximately not only Gaussian beam diffraction, but also the inhomogeneous refractive index term of the vector light wave equation. For the radial component of the electric field the equation predicts typical track diameters at the trapping power thresholds. Author

N72-17480# Raytheon Co., Waltham, Mass. Research Div.
THE PROBABILITY AND DYNAMICS OF DAMAGING OPTICAL MATERIALS WITH LASERS
Michael Bass and Harrison H. Barrett *In* NBS Damage in Laser Mater. Nov. 1971 p 76-90 refs (See N72-17470 08-16)
(Contract F19628-70-C-0223)
Avail: SOD $1.50 as C13.10:356

The probabilistic nature of the damaging interaction between light and matter is discussed. It is shown that when one recognizes that there is some probability to induce damage at any level of optical irradiation, then the reported irreproducible damage resistance properties of many useful materials can be understood. This point of view also explains why some optical components may be safely irradiated many times before damage occurs, though no other change in the material can be detected prior to the observation of damage. Experimental data showing the probability for surface damage as a function of power density are presented for several optically nonlinear materials as well as for glass, fused quartz, and acrylic plastic. The dependence of damage probability on optical field strength is similar to that of the dc ionization coefficients for semiconductors and gases on the applied field. This observation is discussed, and it is suggested that a form of avalanche breakdown might be the cause of laser-induced damage. Author

N72-17481*# GTE Sylvania, Inc., Mountain View, Calif.
OPTICALLY-INDUCED PHYSICAL DAMAGE TO LiNbO3, PROUSTITE, AND LiIO3 **c18**
Wm. D. Fountain, L. M. Osterink, and G. A. Massey *In* NBS Damage in Laser Mater. Nov. 1971 p 91-97 refs (See N72-17470 08-16)
(Contract NAS12-2239; F08606-69-C-0054; N62269-69-C-0029; n00014-70-C-0224)
(NASA-CR-125567) Avail: NTIS; SOD $1.50 as C13.10:356 CSCL 11D

Experiments have been conducted to examine physical damage generated in LiNbO3, proustite, and LiIO3 by 1.064 micromillimeter radiation from mode-locked and Q-switched Nd:YAG lasers. The primary emphasis has been on damage to LiNbO3 from flash-pumped Q-switched lasers, but good data have also been obtained for damage in proustite in the same arrangement as well as with cw-pumped Q-switched Nd:YAG lasers. Fair data have been obtained for damage to LiNbO3 from a flash-pumped mode-locked Nd:YAG laser. Semi-quantitative observations on damage in LiNbO3 Q-switches used in flash-pumped and continuously-pumped Nd:YAG lasers, and on damage in hot LiNbO3 and LiIO3 used for external frequency doubling with these lasers are presented. Author

N72-17482# Holobeam, Inc., Paramus, N.J.
CATASTROPHIC SURFACE DAMAGE PRODUCED IN Ba2NaNb5O15 CRYSTALS DURING INTRACAVITY FREQUENCY DOUBLING **c26**
Robert Webb *In* NBS Damage in Laser Mater. Nov. 1971 p 98-103 refs (See N72-17470 08-16)
(Contract F33615-69-C-1841)
Avail: SOD $1.50 as C13.10:356

The production of a practical, high power, continuous green light source utilizing a frequency-doubled Nd:YAG laser in conjunction with an efficient nonlinear crystalline material, namely Ba2NaNb5O15 is discussed. Several focused intracavity geometries were studied whereby the Ba2NaNb5O15 second harmonic generator was placed between the curved external end mirrors of a 1.065 micron laser; the output mirror being nearly transparent at 0.533 microns. A serious problem due to catastrophic surface damage was encountered during these experiments which prevented sustained 100% conversion over periods of time greater than one minute. Since the crystals were situated within the laser cavity, the damage was always self-limiting in the sense that it completely terminated laser oscillation. Attempts to understand the reasons for this damage are outlined. The inherently nonlinear character of the damage process has been demonstrated, and it is presently conjectured that stimulated Brillouin scattering may be responsible for the observed damage effects. Author

N72-17483# Osaka Univ. (Japan). Dept. of Electrical Engineering.
INVESTIGATION OF DAMAGE IN LASER GLASS
Chiyoe Yamanaka, Takatomo Sasaki, Masanobu Hongyo, and Yasuaki Nagao *In* NBS Damage in Laser. Mater. Nov. 1971 p 105-112 refs (See N72-17470 08-16)
Avail: SOD $1.50 as C13.10:356

Experiments on laser glass damage were performed to

clarify the damage mechanisms and to obtain the information of the most preferable glass for a high-power laser system. For the testing method, passive and active tests were adopted. The plasma formations were always observed in internal and surface fractures. To investigate the plasma behavior, time-resolved photographic and spectroscopic methods were used. The plasma in the glass interior continued longer than that on the surface. The damage threshold on the entrance surface was larger than on the exit surface. The chemical strenthening treatment had some effect in protecting the damage growth on the surface. The mechanism of fracture in laser glass seems to be due to the plasma formation by light which produces a shock wave to cause a cleavage in the glass. Author

N72-17484*# University of Southern Calif., Los Angeles.
DIRECT NONDESTRUCTIVE MEASUREMENT OF SELF-FOCUSING IN LASER GLASS
Brian E. Newman and L. G. DeShazer *In* NBS Damage in Laser Mater. Nov. 1971 p 113-118 refs (See N72-17470 08-16)
(Grant NGR-05-018-044; Contract F44620-71-C-0067; Grant AF-AFOSR-1622-69)
(NASA-CR-125568) Avail: NTIS; SOD $1.50 as C13.10:356 CSCL 20E

A nondestructive technique is described to measure self-focusing in a borosilicate crown glass. It is a direct method in the sense that the time evaluation of only the self-focusing of the transmitted laser pulse is observed. The power of the input pulse is limited to prevent a self-focus from occurring within the test material, and the measurements are performed before the onset of damage or other stimulated processes. This is in contrast to other methods which measure the effects of self-focusing by damage tracks and stimulated inelastic scattering. By comparing the temporal shape of the transmitted pulse on-axis with the input pulse, the nonlinear response curve of the test material can be compared directly to the numerical solutions of the nonlinear wave equation which describes large scale self-focusing. Author

N72-17485# Bausch and Lomb, Inc., Rochester, N.Y.
RUBY LASER DAMAGE THRESHOLDS IN EVAPORATED THIN FILMS AND MULTILAYER COATINGS c26
A. Francis Turner *In* NBS Damage in Laser Mater. Nov. 1971 p 119-123 (See N72-17470 08-16)
(Contracts Nonr-4717; N00014-68-C-0190; ARPA Order 306)
Avail: SOD $1.50 as C13.10:356

A survey-type study of laser damage thresholds in evaporated thin films and multilayer coatings on glass substrates is presented. Q-switched ruby lasers were employed and several common filming materials were included. In the focal of a 42 mm focus lens the damage thresholds ranged from Voules per square centimeter for quarterwave films of MgF2 or SiO2 down to 30 Voules per square centimeter for quarterwave films of ZnS. Multilayer coatings generally had damage thresholds intermediate between the thresholds of their individual films. Author

N72-17486# University of Southern Calif., Los Angeles. Dept. of Physics.
INVESTIGATIONS TOWARD UNDERSTANDING THE PHYSICS OF LASER DAMAGE TO THIN DIELECTRIC FILMS c26
L. G. DeShazer and J. H. Parks *In* NBS Damage in Laser Mater. Nov. 1971 p 124-136 refs (See N72-17470 08-16)
(Contract F44620-71-C-0067; Grants AF-AFOSR-1622-69; AF AFOSR-2066-71)
Avail: SOD $1.50 as C13.10:356

The physical properties of monolayer thin-films before and after intense laser irradiation, utilizing electron microscopic techniques are described. The films are irradiated with emission from three high-power pulsed lasers typical of the state-of-the-art in the UV, visible and IR spectral regions. Specific comments are made of the problems of calibration and control of laser power on both a time-resolved and time-integrated basis. The importance of transverse mode control is demonstrated. Preliminary observations of ZnS layers on cleaved NaCl crystals are presented. Author

N72-17487# Perkin-Elmer Corp., Norwalk, Conn.
AN INVESTIGATION OF LASER INDUCED DAMAGE TO FOUR DIFFERENT SINGLE PURPOSE ANTI-REFLECTION COATINGS ON FUSED SILICA SUBSTRATES c18
R. Russel Austin (AFWL, Kirtland AFB, N. Mex.) and Arthur H. Guenther *In* NBS Damage in Laser Mater. Nov. 1971 p 137-152 refs (See N72-17470 08-16)
Avail: SOD $1.50 as C13.10:356

The one shot laser induced damage threshold of four typical anti-reflection coatings is reported. A damage correlation is attempted on a comparison with the residual stress developed in single and multilayer systems. The coatings studied were layers of: (1) MgO-MgF2, (2) MgF2-SiO2-MgF2, (3) MgF2-ThF4-MgF2, and (4) MgF2. All thin films were electron deposited on quartz substrates and both entering and exiting damage thresholds were determined. The morphology of damage is presented through the use of Nomraski differential interference contrast micrography and scanning electron microscopy. Author

N72-17488# Naval Weapons Center, China Lake, Calif. Michelson Lab.
MINIMIZING SUSCEPTIBILITY TO DAMAGE IN CO2 LASER MIRRORS
H. E. Bennett *In* NBS Damage in Laser Mater. Nov. 1971 p 153-162 refs (See N72-17470 08-16)
Avail: SOD $1.50 as C13.10:356

The absorption of mirror coatings in continuous wave and pulsed laser operation is discussed. The production of very low absorption films for near infrared and visible spectra regions using multilayer dielectric coatings is described. The properties of coated mirrors for high power carbon dioxide laser applications are presented. Author

N72-17489# California Univ., Livermore. Lawrence Radiation Lab.
DYE LASER PERFORMANCE ENHANCEMENT BY CHEMICAL QUENCHING OF THE TRIPLET STATE M.S. Thesis
John B. Marling 6 Jul. 1971 101 p refs
(Contract W-7405-eng-48)
(UCRL-51088) Avail: NTIS

Seven dye lasers were chosen which had tuning potential across the full visible spectrum, and which represented seven different molecular structural families. Under intense optical excitation, all of these dyes exhibited lasing which terminated within 0.5 to 2 microsec after lasing initiation, even though the flashlamp excitation intensity was maintained for 8 microsec at a level above that of lasing initiation threshold. Experimentally discovered chemical additives, when placed in solution with a lasing dye, were found to prevent premature termination of lasing. Other chemical additives were also found to be effective in increasing dye laser pulse length. To be effective, this latter class of additives needed to be excited to their triplet state by the optical pumping required for lasing. Rate equations were developed to describe the time dependence of the dye and additive triplet state populations, taking into account the various possible means of collisional transfer of excitation. Author

N72-17490# McElroy (Ralph) Co., Austin, Tex.
INVESTIGATION OF THE LASER INITIATED DISCHARGE SPARK CHANNEL
N. N. Zorev, G. V. Sklizkov, S. I. Fedotov, and A. S. Shikanov [1971] 20 p refs Transl. into ENGLISH from Russian report preprint no. 56 of Akad. Nauk SSSR, Moscow, Inst. Fiziki Sponsored by AEC Prepared for Lawrence Radiation Lab.
(UCRL-Trans-10556) Avail: NTIS

Experimental measurements were made of the delay time as a function of laser energy, laser beam focus location, electrode spacing, and pressure. The high speed schlieren

method was used in the experiments. The expansion velocity of the spark channel was measured, and the analysis of gas dynamic processes occurring in the gap for the case of various regimes was considered. The results of an approximate calculation of a discharge scheme are in agreement with experimental data. Minimum risetime was evaluated. It was shown that the use of laser methods to commute discharge gaps makes it possible to form light pulses having duration less than 100 psec.
Author (NSA)

N72-17491# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati.
REVIEW ON LASER PRODUCED PLASMAS
A. Caruso Sep. 1970 23 p refs Presented at the 4th European Conf. on Controlled Fusion and Plasma Phys., Rome, 1970
(LGI-70/12/E; Conf-700817-26) Avail: AEC Depository Libraries

A review is presented of experiments aimed at plasma production using lasers. The review considers different targets and different laser pulses. NSA

N72-17492# Maryland Univ., College Park. Dept. of Electrical Engineering.
THE STUDY OF THE INTERACTION OF INTENSE PICOSECOND LIGHT PULSES WITH MATERIAL (MODE-LOCKED LASERS) Quarterly Technical Report, 22 Jun. - 21 Sept. 1971
Chi H. Lee 15 Oct. 1971 24 p refs
(Contract DA-ARO(D)-31-124-71-G55; ARPA Order 675)
(AD-732519) Avail: NTIS CSCL 20/5

Recent advance in the development of mode-locked lasers is reviewed. In particular the principle of generation and the measurement of the picosecond pulses are discussed. Recent measurements on the spectral and temperal characteristics are included. This data can be used to explain some of the discrepancy found in previous measurements. The application of picosecond pulse for lifetime measurement in semiconductors is also discussed. Author (GRA)

N72-17493# Illinois Univ., Urbana. Dept. of Electrical Engineering.
FAR INFRARED MOLECULAR LASER RESEARCH Final Technical Report, 1 Oct. 1970 - 30 Sep. 1971
Paul D. Coleman 30 Sep. 1971 82 p refs
(Contract AF-AFOSR-1976-71; AF Proj. 9768)
(AD-732946; UILU-ENG-71-2555; AFOSR-71-2921TR) Avail: NTIS CSCL 20/5

The report describes research on the laser line assignments and excitation mechanism by glow discharges in the molecules SO2, H2S, and H2O. All 10 laser lines in SO2 have been assigned to the Nu(1), 2Nu(2) levels and an analytical model of the indirect excitation via an electronic state is described. A definitive assignment of laser lines in H2S at the moment appears to require better spectroscopic energy level data on the molecule. A convincing proof that the lines in H2O are excited by direct electron impact is presented along with an analytical model for computing the output laser line waveform. A final section on some preliminary studies of transverse excitation of far infrared lasers is described. Author (GRA)

N72-17494# Defense Documentation Center, Alexandria, Va.
SEMICONDUCTOR LASERS - A DDC BIBLIOGRAPHY, FEBRUARY 1963 - JANUARY 1971
Oct. 1971 134 p refs
(AD-732700; DDC-TAS-71-44) Avail: NTIS CSCL 20/5

The bibliography on semiconductor lasers deals with the theoretical as well as the experimental studies of different lasing techniques. Discussion of injection lasers, diode lasers, electron beam lasers, etc., are represented. The references dealing exclusively and mainly with gallium compound lasers have in general been excluded since they appeared earlier. Included in this bibliography are Corporate Author, Monitoring Agency, Subject, and Title indexes. Author (GRA)

N72-17495# Naval Ordnance Lab., White Oak, Md.
POPULATION INVERSIONS IN AN EXPANDING GAS (THEORY AND EXPERIMENT)
John D. Anderson, Jr., Richard L. Humphrey, John S. Vamos, Michael J. Plummer, and Richard E. Jensen 28 Jun. 1971 42 p refs
(ORD Proj. 832-128/312-31)
(AD-732374; NOLTR-71-116) Avail: NTIS CSCL 20/5

It is well established that population inversions between the (001) and (100) vibrational energy levels of CO2 can be created by rapid expansions of CO2-N2-H2O or He mixtures through supersonic nozzles. New experimental results are presented for such inversions. These experiments were conducted in both the 3-Megawatt Arc Tunnel and the 12.7 cm Shock Tunnel at the Naval Ordnance Laboratory. The results support previously published theoretical predictions obtained with a numerical, time-dependent, nonequilibrium nozzle flow analysis employing a simplified vibrational kinetic model. This theory is also compared with experimental data obtained by other investigators.
Author (GRA)

N72-17496# Arizona Univ., Tucson. Dept. of Physics.
RESEARCH IN THEORETICAL QUANTUM OPTICS Interim Report
Marlan O. Scully Sep. 1971 68 p refs
(Grant AF-AFOSR-1921-70; AF Proj. 9768)
(AD-732793; AFOSR-71-2468TR) Avail: NTIS CSCL 20/5

During the course of AFOSR Contract no. 70-1921 several problems were solved, seven papers were published and substantial progress was made on still other fronts. The areas of research involved include: the detection and emission of coherent infrared radiation by superconducting tunnel junctions (papers 1 and 2), aspects of coherence theory including the revelation of outstanding problems in the quantum theory of laser radiation (papers 3 and 4), the completion of work on laser photon statistical build-up and time dependence which has been several years in coming (paper 5), an invited paper intended to present aspects of the above as well as other problems in a pedagogical review fashion (paper 6), and finally work on the statistics of light scattered from a system near its phase-transition critical point (paper 7). Descriptions and highlights of the above investigations are given in the following sections, and reprints of the papers are enclosed. Author (GRA)

N72-17497# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
OPTICAL EXPERIMENTS WITH LASER SOURCES Final Report, 28 Feb. - 19 Aug. 1971
Walter L. Faust 19 Aug. 1971 6 p refs
(Contract DAHC04-69-C-0003)
(AD-732906) Avail: NTIS CSCL 20/5

The report presents technical findings for the period 28 February 1971 through 19 August 1971, and a summary for the entire duration of this contract which terminated 19 August 1971. Topics included are Light Scattering from Semiconductors, Associated with Impurities, Far Infrared Work, and CO2 Laser Apparatus Development. GRA

N72-17498# Transportation Systems Center, Cambridge, Mass.
AN INVESTIGATION OF OIL FLUORESCENCE AS A TECHNIQUE FOR THE REMOTE SENSING OF OIL Final Technical Report, 1 Jul. 1970 - 30 Jun. 1971
John F. Fantasia, Thomas M. Hard, and Hector C. Ingrao 30 Jun. 1971 127 p refs
(PB-203585; TSC-USCG-71-7) Avail: NTIS CSCL 13B

The feasibility of remote sensing of oil spills by laser-excited oil fluorescence was investigated. The required parameters were measured in the laboratory; these parameters were fed into a physical model to predict signal and background levels; and the

predictions were verified by field experiments. Airborne detection, identification, and quantification of oil spills at sea are shown to be feasible with existing equipment, day or night. (GRA)

N72-17334*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
RECENT DEVELOPMENTS AFFECTING THE HYDROGEN MASER AS A FREQUENCY STANDARD
R. F. C. Vessot, M. W. Levine, P. W. Zitzewitz, P. Debely, and N. F. Ramsey *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 27-37 refs Sponsored in part by NASA, NBS, NSF and ONR Prepared in cooperation with Harvard Coll. Obs. and Harvard Univ., Cambridge, Mass. (See N72-17330 08-14)
(NASA-CR-125576) Avail: NTIS; SOD $6.00 as C13.10:343 CSCL 20E

N72-17337# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
THE USE OF MICROWAVE MODULATION OF LASERS FOR LENGTH MEASUREMENTS
Z. Bay *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 59-62 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

N72-17404# Colorado Univ., Boulder.
A LASER-INTERFEROMETER SYSTEM FOR THE ABSOLUTE DETERMINATION OF THE ACCELERATION DUE TO GRAVITY
James A. Hammond and James E. Faller (Wesleyan Univ., Middeltown, Conn.) *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 457-463 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17891*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
MEASUREMENT OF THE POWER SPECTRAL DENSITY OF PHASE OF THE HYDROGEN MASER
A. Sward *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 30-33 refs (See N72-17887 08-30)
Avail: NTIS CSCL 20E

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N72-17499*# Franklin Inst., Philadelphia, Pa. Research Labs.
POWDER METALLURGY IN AEROSPACE RESEARCH: A SURVEY Technology Utilization
H. W. Blakeslee Washington NASA 1971 173 p refs Sponsored by NASA
(NASA-SP-5098) Avail: NTIS; SOD $1.00 as Stock No. 3300-0397 CSCL 11F
The various techniques by which powders can be produced, as pure metals or as alloys, are discussed; the methods by which these powders can be formed into the final parts are explained as well as further processing that may be necessary to meet specific requirements. The NASA developments are detailed, and references are provided for those who wish to obtain further information characteristic of any methodology. Author

N72-17500*# National Aeronautics and Space Administration, Washington, D.C.
METALLURGY: A COMPILATION Technology Utilization
1972 16 p
(NASA-SP-5940(02)) Avail: NTIS CSCL 11D
A compilation on the technical uses of various metallurgical processes is presented. Descriptions are given of the mechanical properties of various alloys, ranging from TAZ-813 at 2200 F to investment cast alloy 718 at -320 F. Methods are also described for analyzing some of the constituents of various alloys from optical properties of carbide precipitates in Rene 41 to X-ray spectrographic analysis of the manganese content of high chromium steels. E.H.W.

N72-17501*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-TEMPERATURE CREEP OF POLYCRYSTALLINE CHROMIUM
Joseph R. Stephens and William D. Klopp Washington Feb. 1972 12 p refs
(NASA-TM-X-2499; E-6472) Avail: NTIS CSCL 11F
The creep properties of high-purity, polycrystalline chromium were determined over the temperature range 0.51 to 0.78 T sub m, where T sub m is the melting temperature. Creep rates determined from step-load creep tests can be represented by the general creep equation; epsilon/D = k((sigma/E) to the nth power) where epsilon is the minimum creep rate, D is the diffusivity, k is the creep rate constant, sigma is the applied stress, E is the modulus, and n is the stress exponent, equal to 4.3 for chromium. This correlation and metallographic observations suggest a dislocation climb mechanism is operative in the creep of chromium over the temperature range investigated. Author

N72-17502# Joint Publications Research Service, Washington, D.C.
DETERMINING THE MECHANICAL CHARACTERISTICS OF HIGH-STRENGTH STEELS UNDER TENSION
A. P. Gulyayev, D. V. Lebedev, B. M. Ovsyannikov, and L. T. Timoshuk 4 Feb. 1972 6 p refs Transl. into ENGLISH from Zavodsk. Lab. (Moscow), no. 8, 1971 p 967-970
(JPRS-55101) Avail: NTIS
Tests were run on Kh5M2SF steel with varying carbon content and diameters of the working area at 3.7 and 5 mm. The steel was subjected to two different types of treatment. With carbon content of about 0.3% the strength characteristics were the same after both treatments. The ultimate strength for cylindrical and noncylindrical specimens was nearly the same. For high-strength steel (sigma sub v>200 kg/sq mm) in cylindrical specimens, decrease in sigma sub v was observed with carbon content greater than 0.3 to 0.4% for one type of treatment and greater than 0.4 to 0.5% for the other treatment. This was also observed in round noncyclindrical specimens with a higher percentage of carbon and, consequently, a higher fixed strength. This was a direct result of higher psi values in the noncylindrical specimens. K.P.D.

N72-17503*# Scientific Translation Service, Santa Barbara, Calif.
SOME CHARACTERISTICS OF THE CAVITATION EROSION OF METALS IN LIQUID OXYGEN
Yu. Ye. Krut, D. N. Bolshutkin, and V. V. Gavranek Washington NASA Feb. 1972 7 p refs Transl. into ENGLISH from Fiz.-Khim. Mekh. Mat. (Kiev), v. 5, no. 2, 1969 p 214-217
(Contract NASw-2035)
(NASA-TT-F-14164) Avail: NTIS CSCL 11D
The cavitation action of liquid oxygen and water on metals with various lattice arrangements was studied in lead, copper, nickel, iron and zinc. The high resistance of iron and zinc to the cavitation action of oxygen was revealed. The resistance of lead, copper and nickel in cavitating oxygen did not increase in comparison with their resistance in cavitating water. There was no oxidation of the metals during tests in oxygen. Author

N72-17504# Atomic Energy Commission, Washington, D.C.
APPLICATIONS OF FUNDAMENTAL MATERIALS RESEARCH

L. C. Ianniello Aug. 1971 139 p refs
(TID-25798) Avail: NTIS

A compilation of examples of the paths or histories of specific applications of fundamental materials research is presented. A brief discussion is included of the overall merit and risk character of the research, to place it in perspective. From this examination of one total program, the Metallurgy and Materials Research program, some general conclusions are drawn concerning the application of fundamental materials research results. Author (NSA)

N72-17505# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Construction Dept.

PROPERTIES OF ZIRCONIUM ALLOYS FROM THE OPERATION STANDPOINT

R. Filip and J. Velkoborsky 1971 20 p refs
(ZJE-107) Avail: AEC Depository Libraries

The selection of zirconium alloys for the active zone of the gas-cooled heavy water reactor is discussed along with the classification and properties of these alloys from the technical standpoint. Information is given about the technique of zirconium alloy evaluation in relation to their creep and about specific properties of the experimental testing equipment. Author (NSA)

N72-17506# Iowa State Univ. of Science and Technology, Ames.

CAPILLARY RESERVOIR DIFFUSION STUDIES IN Hg-In ALLOYS UTILIZING CONTINUOUS RESISTIVITY MEASUREMENT OF COMPOSITION Ph.D. Thesis

Robert Hamilton Kaiser Sep. 1971 95 p refs
(Contract W-7405-eng-82)
(IS-T-490) Avail: NTIS

Molybdenum electrodes were located at intervals along the capillary so that the composition could be monitored by noting the change in resistivity of the capillary contents. These probes were in the form of annuli which enabled the measurment of resistances without obstructing the diffusion process. This cell was used to measure the composition dependence on the diffusion coefficient in the mercury-indium system at 25 C. Compositions up to 13.19 at.% indium were investigated. When compared with previous data on indium amalgams, the results indicate that the technique is adequate. Author (NSA)

N72-17507# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

STUDY OF THE FORMATION OF CREEP CAVITIES IN POWDER METALLURGY TUNGSTEN Ph.D. Thesis - Tenn. Univ.

James O. Stiegler Sep. 1971 200 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3350) Avail: NTIS

Details of the nucleation and growth of cracks in tungsten produced by a powder metallurgy process were studied by electron fractography. Creep tests were interrupted and the specimens fractured at room temperature to expose any cavities or cracks formed at high temperatures for examination. The model most in agreement with observations is one in which gas bubbles expand to form cavities by the stress-directed diffusion of vacancies along the grain boundaries. The creep rate from the diffusion-controlled growth of equiaxial cavities is in order of magnitude agreement with measured creep rates for materials containing cavities. Some unusual observations made on a powder metallurgy tungsten-25% rhenium alloy which deformed at a faster rate at 1650 C than at 2200 C at a stress of 500 psi are explained semiquantitatively by this model of creep due to cavity growth and observed microstructural features. The characteristics of creep by cavity growth are also described.
Author (NSA)

N72-17508# Iowa State Univ. of Science and Technology, Ames.

ELASTIC CONSTANTS OF Fe-Ni-C ALLOYS Ph.D. Thesis

Daniel Eugene Diesburg Sep. 1971 97 p refs
(Contract W-7405-eng-82)
(IS-T-461) Avail: NTIS

The adiabatic elastic constants of a series of Fe-Ni-C alloy single crystals have been measured in the temperature range M sub s approximately + 10 C to room temperature. Certain criteria have been observed relating elastic constant temperature dependence to martensite morphology. It has been observed that both 2,2,5 and 2,5,9 martensite can be present. Author

N72-17509# Iowa State Univ. of Science and Technology, Ames.

DEBYE TEMPERATURES OF COPPER-RICH, Cu-Au ALLOYS Ph.D. Thesis

William Henry Cullen, Jr. Sep. 1971 79 p refs
(Contract W-7405-eng-82)
(IS-T-478) Avail: NTIS

The composition and temperature dependencies of the electrical resistivity and elastic moduli of alloys in the system Cu-Cu3Au have been measured from 4.2 K to room temperature. The results, which are reported and discussed, suggest that the electronic structure and vibrational spectra are significantly altered upon alloying. The Debye temperatures theta sub r, calculated from the Bloch-Gruneisen equation, and theta sub el' calculated from the elastic moduli--decrease rapidly in the range 0-15 at.% Au. The elastic shear moduli, C and C', and the bulk moduli, B, also decrease in this range. These latter results are discussed in terms of the Fuchs' analysis of the shear moduli of the noble metals. In particular, the possible effects of a Fermi energy contribution to both C and C' are discussed in detail.
Author

N72-17510# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.

DIFFUSION COEFFICIENT AS A GUIDE TO PROSPECTS FOR HIGH-TEMPERATURE ZIRCONIUM ALLOYS

G. J. C. Carpenter Jun. 1971 30 p refs
(AECL-3967) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $1.00

The high temperature creep deformation of metals and alloys was reviewed in an effort to obtain a perspective on prospects for high temperature zirconium alloy development. It was concluded that the most important factor that limits resistance to stress at high temperatures is the rate of self diffusion. This is more important than other fundamental physical properties of zirconium involved in deformation, namely the elastic modulus and the stacking fault energy. Since it is possible, in principle, to include similar obstacles to dislocation motion in any metal, the self diffusion coefficient can be used as a guide to the high-temperature potential for zirconium. On this basis, alpha-zirconium appears to behave as if it had an effective melting point of about 1500 C. It is suggested that a rough guide to the long term development prospects for dilute zirconium alloys based on conventional alloying techniques can be obtained by looking at the creep properties of the low alloy ferritic steels. Author (NSA)

N72-17511# Arizona Univ., Tucson. Dept. of Physics.

HIGH TEMPERATURE ANNEALS OF DEFECTS QUENCHED IN METALS Final Report

Roy M. Emrick 1971 17 p refs
(Contract AT(11-1)-1456)
(COO-1456-16) Avail: NTIS

The effects of pressure, mechanical strain, quenching rate, and vacancy resistance on high temperature annealing of quench defects in metals are discussed. G.G.

N72-17512# Grenoble Univ. (France). Faculte des Sciences.

MEASUREMENT DEVICE AND NUMERICAL ANALYSIS OF ELECTRICAL RESISTIVITY FROM 4 TO 300 K. APPLICATION TO NIOBIUM-HAFNIUM ALLOYS Ph.D. Thesis

J. M. Teixeira 1970 116 p refs In FRENCH
(FRNC-TH-72) Avail: AEC Depository Libraries

Niobium-hafnium alloys were studied from the point of view of superconductivity by making measurements at different temperatures. In this way an apparatus was developed, which uses only one cryogenic liquid and is capable of measurements between 4 and 300 K. Measurements made on a great number of samples with different concentrations and heat treatments allowed the critical temperatures and changes in parameters of the Bloch-Wilson theory to be determined. Identical resistivity laws were obtained for the strain hardened or annealed Nb-Hf samples. NSA

N72-17513# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
STAINLESS STEEL CLADDING DEVELOPMENT Quarterly Progress Report for period ending 30 Jun. 1971
William E. Ray Aug. 1971 40 p refs
(Contract AT(30-1)-4210)
(WARD-4210-T-3-7) Avail: NTIS

The final delivery of tubing ordered for defects evaluation was received and accepted, and the order was closed. Preliminary nondestructuve eddy current characterization of 12 tubing lots, having various finishing steps, was completed and the effects of the variables evaluated. A total of 12 stress rupture tests in argon and one in air of defected and non-defected specimens were completed. The results were compared with the stress rupture curve previously obtained for this lot of material. A preliminary and tentative evaluation was made of the effect of longitudinal defects on rupture life, rupture ductility, local wall strain, and rupture morphology. Author (NSA)

N72-17514# Oak Ridge National Lab., Tenn.
TRANSMISSION AND SCANNING ELECTRON MICROSCOPE OBSERVATIONS OF NIOBIUM-HAFNIUM ALLOYS
R. W. Carpenter Sep. 1971 11 p refs Presented at the 5th Intern. Mater. Symp., Berkeley, Calif., 13 Sep. 1971 Sponsored by AEC
(Conf-710916-1) Avail: NTIS

Experimental observations showed that the fracture morphology in heat-treated Nb-Hf alloys, which were homogenized and quenched, underaged, overaged, and aged to maximum hardness at 600 C, was generally the same. Each fracture examined contained areas of transgranular shear and grain boundary separation. Both areas proved to be composed of small rough cups with shear lips, with the grain boundary separations on a finer scale. On specimens where the grain boundary precipitate was prominent enough to be clearly seen on the fracture surface, it was observed to be quite ductile. The large differences in fracture behavior found were macroscopic in nature. Accommodation strains at triple points were obvious locations for fracture nuclei that should grow rapidly under the influence of large hydrostatic tension. The hydrostatic tensile stress was 100,000 psi for specimens aged to near maximum strength. It was concluded that this high level of induced stress is the principal reason for the observed minimum in elongation and reduction in area. NSA

N72-17515# Oak Ridge National Lab., Tenn.
VOID DAMAGE IN NEUTRON IRRADIATED STRUCTURAL METALS
E. E. Bloom and J. O. Stiegler Sep. 1971 21 p refs Presented at the Seminar on Radiation Effects in Metals and Structural Mater., Kyoto, 28 Sep. 1971 Sponsored by AEC
(Conf-710917-1) Avail: NTIS

The tensile and creep-rupture properties of Types 304 and 304 + 0.15% Ti stainless steels were determined after irradiation at temperatures in the range 370 to 800 C to maximum fast neutron fluences of 3 x 10 to the 22nd power neutrons/cm2. Changes in mechanical properties were related to the radioinduced defects. When irradiated in the annealed condition in the neighborhood of 400 C, Type 304 stainless steel exhibited an increased yield stress, reduced strain hardening coefficient, and reduced uniform and total elongation. The increased yield stress could be correlated with the strengthening expected from irradiation-produced voids and dislocations. With increasing irradiation temperature the concentration of these defects decreased and thus the magnitude of the yield stress increase became less. At 500 to 600 C a pronounced reduction in creep-rupture ductility was observed. It is suggested that in this temperature range the void-dislocation structure together with the transmutation produced helium were responsible for the intergranular fractures and low ductilities. Author (NSA)

N72-17516# Oak Ridge National Lab., Tenn.
NUCLEATION AND GROWTH OF VOIDS IN STAINLESS STEELS DURING FAST NEUTRON IRRADIATION
E. E. Bloom Oct. 1971 46 p refs Presented at the Intern. Conf. on Radiation Induced Voids in Metals, Albany, 9-11 Jun. 1971 Sponsored by AEC
(Contract W-7405-eng-26)
(ORNL-TM-3492; Conf-710601-15) Avail: NTIS

The nucleation and growth of voids and dislocation loops in austenitic stainless steels were investigated by transmission electron microscopy and immersion density measurements. The effects of temperature, neutron flux, and neutron fluence on the concentration and spatial and size distribution of dislocations and voids are reviewed. Available results on the effects of composition and preirradiation microstructure are compared and related to data on annealed Type 304 stainless steel. The experimental observations are compared to the predictions of various void nucleation mechanisms. The results do not appear to be in agreement with the predictions of homogeneous nucleation theory as presently formulated. Nucleation mechanisms involving the presence of gases such as helium are capable of explaining many of the observations and trends but have not been described analytically. Void growth appears to be controlled by vacancy diffusion. Author (NSA)

N72-17517# Los Alamos Scientific Lab., N.Mex.
INVESTIGATION OF A HIGH-DENSITY TUNGSTEN-BASE ALLOY
H. Sheinberg, J. T. Frakes, and R. E. Riley Oct. 1971 17 p refs
(Contract W-7405-eng-36)
(LA-4695) Avail: NTIS

The effect of sintering time, temperature and atmosphere, post-sintering heat treatments, tungsten particle size, and compositional variations upon the mechanical properties and structure of a 95 wt % W-3.5 wt % Ni-1.5 wt % Fe base alloy were investigated. Improvements were observed with postsintering heat treatments, fine tungsten powders, and small rhenium or chromium additions. Author (NSA)

N72-17518# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
STAINLESS STEEL CLADDING DEVELOPMENT Quarterly Progress Report for period ending 31 Mar. 1971
William E. Ray May 1971 39 p refs
(Contract AT(30-1)-4210)
(WARD-4210-T-3-4) Avail: NTIS

Results of tests, measurements, and observations made during the report period on vacuum melted steels, except for identification of precipitates in post-stress rupture specimens, are reported. Seven long-term stress rupture tests were completed. Seven tested specimens and two control specimens were prepared in special mounts, and cathodic vacuum etched. The microstructures were evaluated for grain size and shape, and cavity distribution. Strain profile measurements were made for 17 additional post-stress rupture test specimens bringing the total number of specimens evaluated by this approach to 53. Rupture ductilities and shoulder ductilities were measured for each of these specimen and evaluated with respect to test stress and material properties. Author (NSA)

N72-17519# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.

LONG-TIME CORROSION STUDIES ON AUSTENITIC CrNi STEELS AND NICKEL BASE ALLOYS IN SUPERHEATED STEAM (620 C/1 atm), WITH SPECIAL ATTENTION TO THE BEHAVIOR OF COLD WORKED MATERIAL SURFACES

S. Leistikow, H. V. Berg, and E. Pott Feb. 1971 84 p refs Transl. into ENGLISH from the German report KFK-1301 In GERMAN and ENGLISH

(EURFNR-911; KFK-1301) Avail: NTIS

As contribution to a suitable choice of cladding materials for nuclear superheat reactors, seven superheat materials were tested in semidynamic steam loop experiments at 620 C, and 1 atm during 5000 hours and in three different surface-or bulk conditions. The experiments were evaluated by gravimetric measurements, chemical analysis of the steam condensate, and metallography. The results verified the increased corrosion resistance of nickel alloys in case of annealed material, the effect of increasing corrosion in case of oxidation of chromium depleted surfaces or coarse grain structures. Cold worked specimens of all alloys tested corroded uniformly and to an extent which was strongly diminished in the case of CrNi steels. The high corrosion resistance which was built up by selective chromium diffusion and oxidation proved its long-time effectiveness through 10,000 hours of testing. Author (NSA)

N72-17520# Atomics International, Canoga Park, Calif.

EFFECT OF HELIUM ON CREEP OF TYPE 316 STAINLESS STEEL AT 700 C

K. R. Garr, C. G. Rhodes, and D. Kramer 3 Sep. 1971 23 p refs

(Contract AT(04-3)-824)

(AI-AEC-13009) Avail: NTIS

Small helium-injected samples of Type 316 stainless steel were creep tested in vacuum, under constant load conditions, at 700 C, with an initial stress of 10.0 kg/sq mm. The emphasis was on interrupted tests so that the microstructural changes taking place during creep could be observed. Helium reduced the rupture life and ductility of the alloy. It also increased the secondary creep rate and changed the failure mode from transgranular to intergranular, but did not affect the intragranular deformation mechanisms. Helium is swept into the grain boundaries by dislocation motion very early in the creep process. This increases grain-boundary sliding, as shown by separate tensile test results. Author (NSA)

N72-17521# Rutherford High Energy Lab., Chilton (England).

NON-MAGNETIC STAINLESS STEELS FOR CRYOGENIC PURPOSES

D. C. Larbalestier and H. W. King Jan. 1971 24 p refs

(RHEL/R-217) Avail: AEC Depository Libraries; HMSO 25p; PHI $1.15

An investigation of the magnetic properties of the austenitic stainless steels at low temperatures was conducted. Recommendations for the avoidance of ferromagnetism in these steels are made, with particular reference to those considered for the high field bubble chamber. Author (NSA)

N72-17522# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.

EFFECT OF ANNEALING ON THE SUBSTRUCTURE OF COLD WORKED FCC METALS AND ALLOYS Technical Progress Report, 1 Sep. 1970 - 1 Sep. 1971

D. E. Mikkola, D. J. Borich, E. T. Marsh, C. L. Rase, and W. G. Truckner 1 Sep. 1971 31 p refs

(Contract AT(11-1)-1431)

(COO-1431-12; TPR-7) Avail: NTIS

The effect of annealing on the substructure of cold worked metals and alloys was studied. The mechanisms of annealing and the relation between structure and property changes occurring during annealing were considered. X-ray diffraction and transmission electron microscopy are being used to examine the substructural changes and these changes are then related as quantitatively as possible to precisely measured properties. Studies were carried out on alpha-Cu-Ge solid solutions and binary alloys ordered in the L1 sub 2 structure. The changes in substructure that take place during the annealing of a deformed material are discussed and will provide information about the means by which defects introduced by deformation are rearranged and/or eliminated. Simultaneous property measurements can establish the contributions of specific defects and arrangements of defects to the properties. Author

N72-17523# Rocky Flats Div., Dow Chemical Co., Golden, Colo.

LITERATURE SURVEY OF STRESS-CORROSION CRACKING AND HYDROGEN EMBRITTLEMENT IN HIGH STRENGTH STEELS

John L. Briggs 17 Sep. 1971 12 p refs

(Contract AT(29-1)-1106)

(RFP-1717) Avail: NTIS

A literature survey was conducted to determine the stress-corrosion cracking properties of three high strength steels. The steels of concern are Vascomax 250 (an 18Ni maraging steel), Almar 362 (a stainless maraging steel), and HP9Ni-4CO-.20C(a quenched and tempered martensitic steel). Other topics included in the survey are hydrogenstress cracking general corrosion resistance, welding and a suitable method for cleaning the high strength steels. Author

N72-17524# Rocky Flats Div., Dow Chemical Co., Golden, Colo.

CORROSIVE BEHAVIOR OF 304 AND 304L STAINLESS STEEL IN GASEOUS ENVIRONMENTS: AN ANNOTATED BIBLIOGRAPHY

Linden M. Steward and Jerry L. Stakebake 22 Oct. 1971 18 p refs

(Contract AT(29-1)-1106)

(RFP-1733) Avail: NTIS

The available literature on the gaseous corrosion of types 304 and 304L stainless steel has been reviewed. This report summarizes the results of some typical chemical reactions between 304 and 304L and various gases. References to the general area of stress corrosion were not included in this survey. Included are abstracts from 72 references. Author

N72-17525# Rensselaer Polytechnic Inst., Troy, N.Y. Materials Div.

ORDERING AND THE STRENGTH OF AN ALIGNED AG-3MG-AGMG EUTECTIC

Y. G. Kim and N. S. Stoloff 31 Oct. 1971 26 p refs

(Contract N00014-67-A-0117-0010)

(AD-732010; TR-1) Avail: NTIS CSCL 11/6

A fine lamellar structure with interlamellar spacings from 1 to 7 microns has been produced by directional solidification of an Ag3Mg-AgMg eutectic alloy. The tensile properties were measured as a function of test-temperature, interlamellar spacing, lambda, and degree of order in the AgMg phase. The dependence of flow stress on lambda to the minus 1/2 power increased sharply with ordering of 'Ag3Mg and this strengthening persisted at elevated temperatures. Work hardening rate and ductility of the eutectic at low temperatures also were affected, leading to the conclusion that ordering changes the compatability of slip across inter-phase boundaries. Author (GRA)

N72-17526# Army Foreign Science and Technology Center, Charlottesville, Va.

SPECIFICS OF INTERACTION OF QUASISTABLE LASER RADIATION WITH METALS

B. M. Zhiryakov, A. K. Fannibo, and N. N. Yuryshev 3 Aug. 1971 9 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 3, 1968 p 126-128

(AD-732503; FSTC-HT-23-1186-71) Avail: NTIS CSCL 11/6

The quasistable interaction of laser radiation with metals is

studied experimentally. Comparative analysis of the results with the results of the interaction of a radiation beam with the same energy and total pulse length but significantly different structure indicates that the mechanisms of the interactions differ qualitatively. Possibilities exist for using quasistable radiation for welding and melting of metals. GRA

N72-17527# General Electric Co., Schenectady, N.Y.
SOLUTE SEGREGATION AND STRESSES GENERATED AROUND GROWING VOIDS IN METALS
T. R. Anthony Jul. 1971 12 p refs Sponsored by the Army Res. Office
(AD-732507; Rept-71-C-219; AROD-8156-5-MC) Avail: NTIS CSCL 11/6

A quantitative description of the solute segregation generated by vacancy currents around growing voids is given. Predictions of this theory are compared with direct measurements of vacancy currents, impurity currents, and solute segregation around voids in various metal alloys. From these experiments and theory, the atomic jump frequencies of vacancies around solute atoms in these alloys are obtained. Segregation around other vacancy sinks such as dislocations and grain boundaries is also considered. The effects of solute segregation on the surface energy of voids and the vacancy diffusion coefficient around voids are shown to lead in many cases to an increase in the total number of voids and a decrease in their average size. The stresses generated by solute segregation around voids are calculated. These stresses are shown to be capable of preventing void growth when solute segregation is excessive. Finally, it is suggested that long-range stresses generated by solute segregation around voids can lead to an ordering of voids on spatial arrays to minimize the elastic energy of a material.
Author (GRA)

N72-17528# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
AN ELECTRON MICROSCOPE STUDY OF CONFIGURATIONAL EQUILIBRIUM AT TWIN GRAIN BOUNDARY INTERSECTIONS IN FCC METALS Technical Report, Apr. - Nov. 1970
Richard J. Horylev and Lawrence E. Murr Sep. 1971 123 p refs
(Contract N00014-67-A-0269-0010; NR Proj. 031-735)
(AD-732382; USCEE-405; TR-3) Avail: NTIS CSCL 11/6

A transmission electron microscopy study of 304 stainless steel thin films was undertaken in order to completely characterize twin boundary-grain boundary intersection systems in fcc metals. The degrees of freedom associated with each grain boundary were determined and their interrelationships with grain boundary energy and associated torques were systematically investigated. A geometric configurational theory was developed to explain the existence of interfacial torques at twin boundary-grain boundary intersections and the verification of the physical existence of these torques was obtained. The origin, as well as the effects of torques on the twin boundary-grain boundary intersection system, were determined, and high- and low-torque values were defined.
Author (GRA)

N72-17529# Bureau of Mines, Washington, D.C.
EFFECT OF TEMPERATURE ON THE ELECTROLYTIC PREPARATION AND RECOVERY OF SAMARIUM-COBALT ALLOY
Edward Morrice and M. M. Wong 1971 15 p refs
(PB-203665; BM-RI-7556) Avail: NTIS CSCL 11F

The effect of the temperature of SmF3-LiF electrolyte on the electrolytic preparation of samarium-cobalt alloy by the consumable cathode technique was investigated. The temperatures of the cathode zone, alloy collection zone, and samarium oxide (Sm203) feed zone had to be controlled carefully to obtain a satisfactory samarium-cobalt alloy product. Any appreciable deviation from certain temperature values adversely affected yield and product quality. Author (GRA)

N72-17530# Bureau of Mines, Washington, D.C.
CREEP AND OTHER PROPERTIES OF EXTRUDED ZINC-30 PERCENT ALUMINUM ALLOYS CONTAINING MAGNESIUM
L. A. Neumeier and J. S. Risbeck Jul. 1971 32 p refs
(PB-203652; BM-RI-7538) Avail: NTIS CSCL 11F

Creep and other properties of extruded Zn-30 pct Al alloys containing 0 to 0.7 pct Mg are evaluated. The alloys were extruded both above and below the Zn-Al eutectoid temperature of 275 C. Tensile properties, hardness, thermal expansivity, impact resistance, and microstructures are given. The alloys, either with or without magnesium, required substantially less pressure for extrusion near 275 C than at higher or lower temperatures. The alloys containing magnesium exhibited significantly greater hardness, tensile strength, and creep resistance, but much lower ductility than the Zn-30 pct Al alloy.
Author (GRA)

N72-17531# Naval Ship Research and Development Center, Bethesda, Md. Final Report
EFFECTS OF MICROSTRUCTURE, COMPOSITION, AND STRENGTH ON THE STRENGTH-DIFFERENTIAL PHENOMENON OBSERVED IN HY-80 STEEL
Marcel L. Salive and Abner R. Willner Oct. 1971 56 p refs
(SF Proj. 35-422-212)
(AD-733068; NSRDC-3701) Avail: NTIS CSCL 11/6

Steels from 22 heats of low-carbon Ni-Cr-Mo steel (MIL-S-16216 G and ASTM A543-65) were heat treated to study the effects on the strength-differential effect and the difference between tensile and compressive yields strength of (1) commercial variation in composition and inclusion content, (2) variation in microstructure such as prior austenitic grain size and the relative amount of isothermally produced ferrite or bainite in a tempered martensitic matrix, and (3) the observed variation in strength obtained after a 1-hour 1150 F temper followed by a water quench to prevent embrittlement while cooling from the tempering temperature. The difference between the tensile and compressive yield strength, sometimes called the strength differential (S-D) effect, was observed in this study to be at least 5 percent of the tensile yield strength. Data are cited to show that in the low-carbon Ni-Cr-Mo steels studied here, the S-D effect observed was a relatively constant percent of the tensile yield strength, and was markedly structure-sensitive to prior austenitic grain size, microstructural constituents, tempering temperature, type and distribution of carbides formed during tempering, and tempering slightly above the lower critical temperature. Author (GRA)

N72-17679*# National Aeronautics and Space Administration, Washington, D.C.
EFFECT OF CRYOGENIC IRRADIATION ON NERVA STRUCTURAL ALLOYS
C. E. Dixon, M. J. Davidson, and C. W. Funk *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 603-608 (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 11F

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N72-17532* IIT Research Inst., Chicago, Ill.
SYNTHESIS OF ZINC TITANATE PIGMENT AND COATINGS CONTAINING THE SAME Patent
Daniel W. Gates, Gene A. Zerlaut, and Frederick O. Rogers, inventors (to NASA) Issued 21 Sep. 1971 6 p Filed 11 Apr.

1968 Sponsored by NASA
(NASA-Case-MFS-13532; US-Patent-3,607,338; US-Patent-Appl-SN-720546; US-Patent-Class-106-292; US-Patent-Class-106-299) Avail: US Patent Office CSCL 11C

The vacuum preparation of zinc titanate pigment which is resistant to degradation of reflective properties upon exposure to ultraviolet radiation is described. Zinc oxide is made to react with anatase (titanium dioxide) at a molar ratio of 2:1 and a temperature of at least 900 C. The product is placed in contact with a zinc oxide extractant solution. The pigment prepared by this process is combined with a suitable binder to produce degradation-resistant coatings.

Official Gazette of the U.S. Patent Office

N72-17533*# Furane Plastics, Inc., Los Angeles, Calif.
DEVELOPMENT OF ORGANIC NON-FLAMMABLE SPACECRAFT POTTING, ENCAPSULATING AND CONFORMAL COATING COMPOUNDS Final Report
S. L. Lieberman 16 Dec. 1971 394 p refs
(Contract NAS9-8750)
(NASA-CR-115364) Avail: NTIS HC $6.00/MF $0.95 CSCL 11D

The overall program objective was to develop a flexible compound which not only functioned in a manned aerospace environment as an effective electrical insulation, but whose flammability characteristics in 16.5 psia, 60% oxygen/40% nitrogen were evidenced by rapid self-extinguishment and minimal thermal (pyrolysis) degradation. The following polymeric matrices were examined in depth: fluoroelastomers, modified fluoroelastomers, silicone RTV's, and modified silicone and fluorosilicone RTV's. Almost none of these systems burned in air, but all burned in 6.2 psia oxygen. Inorganic, organic, and inorganic/organic additives were evaluated in conjunction with these polymers in order to achieve the required survival in the 16.5 psia 60/40 environment. Depending upon formulations, it was possible to achieve nonflammable products when tested in the 1/4 in. x 1/4 in. x 1 in. configuration, even up to and including 16.5 psia oxygen. However, in order to assure this level of flame resistance, it was found necessary to heavily load the matrix with the additives. This resulted in a significant reduction in mechanical properties and large increases in viscosities. Optimization of formulations to obtain a suitable balance between these properties and flammability resistance led to the final selection of Formulation 387 as the primary system.

Author

N72-17534*# United Aircraft Corp., East Hartford, Conn. Research Labs.
DETERMINING AND ANALYZING THE STRENGTH AND IMPACT RESISTANCE OF HIGH MODULUS GLASS Quarterly Status Report
James F. Bacon 15 Nov. 1971 34 p refs
(Contract NASw-2209)
(NASA-CR-125572; K911105-3; QSR-3) Avail: NTIS CSCL 11D

An error was noticed recently in the computer program used to reduce the laboratory sonic measurements to tabulated values of Young's modulus of the bulk samples of experimental glasses. Correction of this error gave revised values for the last fifty experimental glasses prepared in this laboratory. This corrected data, when examined as input material for the calculation of Young's modulus of bulk glasses from composition by the C. J. Phillips procedure, resulted in new values for the contribution per mol of several oxides. The new value for the zinc oxide molal factor is especially significant since it is slightly greater than the factor for beryllia for the types of glasses melted in the UARL research program. This discovery provides a new tool in the search for nontoxic, i.e. without beryllia, high modulus glass fibers particularly when coupled with recent measurements that showed zinc oxide contributes significantly to increased impact strength. New glass compositions prepared in this period and the latest impact strength values measured are also included.

Author

N72-17535*# General Electric Co., Schenectady, N.Y.
ALUMINIDE COATINGS FOR NICKEL BASE ALLOYS
H. C. Fiedler and R. J. Sieraski 12 Nov. 1971 74 p refs
(Contract NAS3-14300)
(NASA-CR-120871; SRD-72-028) Avail: NTIS CSCL 11D

The metalliding process was used to aluminide IN-100 and TD NiCr. Aluminum was deposited over a broad range of deposition rates, with two types of coating structures resulting. Chromium, silicon, titanium and yttrium were also individually deposited simutaneously with aluminum on IN-100. None of these had a marked effect on the oxidation resistance of the aluminide coating. Porosity-free aluminide coatings with good oxidation resistance were formed on TD NiCr providing the aluminum concentration did not exceed 8 percent, the limit of solubility in the gamma phase.

Author

N72-17536*# National Aeronautics and Space Administration, Washington, D.C.
THE MULTILAYERED BLACK MIRROR
M. M. Koltun Feb. 1972 8 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (Belorussia SSR), v. 12, Feb. 1970 p 350-352
(NASA-TT-F-14183) Avail: NTIS CSCL 11D

Requirements are delineated for the selective optical coatings that are black in the visible and white in the infrared portions of the spectrum. Spectral and integral optical characteristics are described for four-and six-layer coatings on copper and aluminum consisting of alternating layers of nickel (10 to 15 microns thick) and silicon dioxide (80 to 98 microns thick). The coatings described feature a solar integral absorption coefficient of between 0.92 and 0.96; the thermal integral absorption coefficient at 30 C is from 0.07 to 0.12. The optical characteristics remain stable during prolonged solar and ultraviolet irradiation at 150 C and at temperatures up to 350 C in a vacuum.

Author

N72-17537*# Astro Research Corp., Santa Barbara, Calif.
PHYSICAL PROPERTIES OF THIN FILMS Final Report
P. R. Preiswerk and M. E. Lippman Washington NASA Feb. 1972 31 p refs
(Contract NAS7-728)
(NASA-CR-1972; ARC-R-481) Avail: NTIS CSCL 11D

Studies and experiments are presented on carbon, boron, aluminum oxide, zirconium silicate, aluminum, and titanium vapor-deposited on polyimide film substrates.

Author

N72-17538*# Astro Research Corp., Santa Barbara, Calif.
IN-SPACE FABRICATION OF THIN-FILM STRUCTURES Final Report
M. E. Lippman Feb. 1972 18 p refs
(Contract NAS7-728)
(NASA-CR-1969; ARC-R-410) Avail: NTIS CSCL 11D

A conceptual study of physical vapor-deposition processes for in-space fabrication of thin-film structures is presented. Potential advantages of in-space fabrication are improved structural integrity and surface reflectivity of free-standing ultra-thin films and coatings. Free-standing thin-film structures can find use as photon propulsion devices (solar sails). Other applications of the concept involve free-standing shadow shields, or thermal control coatings of spacecraft surfaces. Use of expendables (such as booster and interstage structures) as source material for the physical vapor deposition process is considered. The practicability of producing thin, textured, aluminum films by physical vapor deposition and subsequent separation from a revolving substrate is demonstrated by laboratory experiments. Heating power requirement for the evaporation process is estimated for a specific mission.

Author

N72-17539# Joint Publications Research Service, Washington, D.C.
A METHOD OF DETERMINING THE EFFECTIVENESS OF FILTER MATERIALS FOR THE STERILIZATION OF AIR
G. L. Motina, P. I. Basmanov, and A. A. Revin 4 Feb. 1972

8 p refs Transl. into ENGLISH from Khimiko-Farmatsevt. Zh. (Moscow), no. 12, 1971 p 28-31
(JPRS-55104) Avail: NTIS

An oil vapor method is used to determine the effectiveness of air sterilization filter materials. It establishes the magnitude of the oil vapor aerosol concentration passing through the filter by comparison with concentrations before filtering, and by calculating the passage coefficient of the oil filter at a 0.3 mm oil vapor drop diameter. Output and effectiveness of two industrial filters for atmospheric air are shown. G.G.

N72-17540# Bureau of Mines, Pittsburgh, Pa.
CLASSIFICATION TEST METHODS FOR OXIDIZING MATERIALS
J. M. Kuchta, A. L. Furno, and A. C. Imhof 1972 16 p refs
(DOT-Proj. OS-00007)
(BM-RI-7594; LC-622.06173; TN23.U7; Dewey-7594) Avail: NTIS

Bench-scale test methods were developed for the classification of solid and liquid oxidizers. A burning rate test is recommended for evaluating the fire hazard of solid inorganic oxidizers when mixed with a red oak sawdust as the reference combustible. A spontaneous ignition test is proposed for evaluating liquid and solid inorganic oxidizers which may decompose violently or ignite spontaneously when unmixed or mixed with the wood sawdust under unconfined conditions. Test results are compared for various representative oxidizers and a classification system is proposed for use in the government transportation regulations. Author

N72-17541# Bendix Corp., Kansas City, Mo.
THE BEGGS MMD TEST FOR DETERMINING THE SHELF LIFE OF FILM ADHESIVE
C. J. Camp and R. L. Beggs May 1971 17 p
(Contract AT(29-1)-613)
(BDX-613-507) Avail: NTIS

The Beggs MMD test was developed to determine whether the shelf life of FM 123-5 adhesive (Bloomingale Department of American Cyanamid Co.) has expired. Factors affecting the reliability of test results were evaluated, and modifications were made to the three-piece metal device used for extrusion of adhesive specimens. Evaluations were then made with the device to determine the effects of various cure conditions on the percent of flow of the adhesive. Author

N72-17542# Sandia Labs., Albuquerque, N.Mex.
FREQUENCY-FILTERING THEORY FOR THE PROPAGATION OF STRESS PULSES IN COMPOSITE MATERIALS
D. S. Drumheller Jul. 1971 25 p refs Sponsored by AEC
(SC-DR-71-0472) Avail: NTIS

Geometric dispersion caused by the heterogeneous nature of composite materials is an important factor to be considered when studying wave propagation in these materials. A wave-filtering concept is used to approach this problem. Simply, this concept implies that composite materials transmit only those components of a shock pulse with frequencies below some characteristic frequency of the composite, the filtering frequency. Author

N72-17543# Los Alamos Scientific Lab., N.Mex.
HIGH TEMPERATURE COMPRESSIVE CREEP AND HOT HARDNESS OF URANIUM-PLUTONIUM CARBIDES
Michael Tokar Jul. 1971 13 p refs
(Contract W-7405-eng-36)
(LA-4704) Avail: NTIS

The compressive creep of uranium-plutonium carbides having the composition U sub 0.79 Pu sub 0.21 C sub 1.02 and a sintered density of 11.8 g/ccm was studied at 13,00, 14,00 and 1500 C and stresses of 2000, 4000, and 6000 psi. The dominant creep mechanism was probably grain boundary sliding. The hardness of some monocarbides with various U/Pu ratios was measured from room temperature to 1200 C. Probable mechanisms of deformation are discussed. Author (NSA)

N72-17544# Marquette Univ., Milwaukee, Wis. Coll. of Engineering.
ELECTRICAL CONDUCTIVITY OF CaO-DOPED NONSTOICHIOMETRIC Ce1 PLUS y02 FROM 700 C TO 1500 C
F. S. Brugner and R. N. Blumenthal 1971 30 p refs
(COO-1441-14) Avail: NTIS

The electrical conductivity of sintered specimens of CaO-doped CeO2 (0.1 to 7.0 mole %) was measured from 1 to 10 to the -22nd power atm of oxygen. All specimens of CaO-doped CeO2 exhibited mixed conduction. Predominantly ionic conductivity was observed at low temperatures and high oxygen partial pressures. High temperatures and lower oxygen partial pressures were dominated by electronic conductivity. In the CaO-content temperature and oxygen-pressure regions investigated, the electronic conductivity was rationalized in terms of a defect model involving nonstoichiometric defects and impurity-generated defects. Author (NSA)

N72-17545# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
ELECTRICAL AND MAGNETIC PROPERTIES OF AMORPHOUS Pd-Si ALLOYS CONTAINING Fe AND Cr
Ryusuke Hasegawa Sep. 1971 17 p refs
(Contract AT(04-3)-822)
(CALT-822-36) Avail: NTIS

Results of the measurements of the electrical resistivity, magnetization and magnetoresistivity of amorphous Fe(x)Cr(2-x) Pd78Si20 alloys are presented. Both the electrical and magnetic properties are affected considerably by small amounts of Fe (approximately 0.5 at. percent). A large internal field due to the interactions between the magnetic atoms and a reduction of about 60 percent of the s-d exchange integral seem to explain the suppression of the Kondo effect in the Cr-Pd-Si alloys containing small amounts of Fe. The scattering of the data for the resistivity minimum temperature and for the magnetoresistivity previously found in the amorphous Cr-Pd-Si alloys can be attributed to the Fe impurities present in Pd. Author

N72-17546# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
FABRICATION OF DISCONTINUOUS, HIGH-FIBER-CONTENT, ISOTROPIC CARBON-CARBON COMPOSITES
F. Lambdin and J. L. Cook 7 Oct. 1971 49 p refs
(Contract W-7405-eng-26)
(Y-1784) Avail: NTIS

A fabrication procedure was developed incorporating short, small diameter carbon fibers into high fiber content (37 to 50 vol %), medium fiber content (20 to 35 vol %), and low fiber content (15 vol %) carbon-carbon composites. All composites were densified by either conventional liquid pitch impregnation and carbonization, a combined high pressure pitch impregnation and carbonization in a gas autoclave, or a combination of these methods. High density, nearly isotropic, low porosity carbon-carbon composites resulted with little or no residual stress due to shrinkage which occurred during processing. Author

N72-17547# Sandia Corp., Albuquerque, N.Mex.
ULTRASONIC EVALUATION OF CARBON-CARBON COMPOSITE MATERIALS
Robert A. Baker and John L. Irwin Oct. 1970 31 p refs Sponsored by AEC
(SC-R-70-4389) Avail: NTIS

A two-fold study was conducted to determine the feasibility of measuring nondestructively one critical material property, the elastic modulus, and of locating internal flaws in pyrolytic carbon infiltrated felt material through the use of ultrasonic testing. It was especially desirable to determine if such nondestructive test data taken from small samples could be extrapolated to bulk material properties. Seven hundred samples were examined and the ultrasonic velocity measured. Bulk densities were independently measured and an ultrasonic material modulus, was calculated. This value, compared to the destructively measured Young's modulus, showed a definite relationship from which

correlation equations were determined. The effect of sample diameter on ultrasonic longitudinal velocity was also investigated. It was determined that the ultrasonic velocity was lower in samples where the diameter-to-wavelength ratio was 2:1 or less. Curves were plotted showing this relationship. Author

N72-17548# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
FABRICATION OF ISOTROPIC FIBROUS CARBON-CARBON COMPOSITES
J. L. Cook and F. Lambdin 30 Oct. 1970 16 p refs Presented at the Conf. on Continuum Aspects of Graphite Design, Gatlinburg, Tenn., 9-12 Nov. 1970
(Contract W-7405-eng-26)
(Y-DA-3953; Conf-701105-1) Avail: NTIS

A technique for fabricating near-isotropic composites from anisotropic, discontinuous fibers and particulate coal tar pitch has been developed. Using a unique high pressure impregnation-carbonization procedure, solids and hollow shells were densified. These composites demonstrated exceptional thermal shock and ablation resistance. Author

N72-17549# Boeing Co., Philadelphia, Pa. Vertol Div.
DETERMINATION OF PHYSICAL AND STRUCTURAL PROPERTIES OF MIXED-MODULUS COMPOSITE MATERIALS Final Report
Robert L. Pinckney and Richard B. Freeman Jun. 1971 70 p
(Contract DAAJ02-69-C-0059)
(AD-732489; D210-10196-1; USAAVLABS-TR-71-7) Avail: NTIS CSCL 11/4

The objective of the program was to determine the physical and structural properties of mixed-modulus composite materials using combinations of graphite and S-glass fibers under static and fatigue loading conditions. This report covers the work completed under Phase I and Phase II of the program and summarizes the data obtained for solid laminates, tubular specimens and sandwich beams in which the S-glass material was oriented parallel to the longitudinal axis of the specimens and the graphite fibers were oriented at plus or minus 45 degrees to the same axis. The test results are tabulated in appropriate engineering format. S-N curves are included to illustrate the fatigue performance of the materials. Stress-strain and S-N curves are compated to appropriate data on pure S-glass and pure graphite material where such data contributes to an understanding of the mixed materials performance. The data indicates that the mixed-modulus system of S-glass and graphite is compatible with the structural and failure mode requirements of helicopter rotor blades. Author (GRA)

N72-17550# Union Carbide Corp., Tarrytown, N.Y.
DEVELOPMENT OF AN IMPROVED DUST CONTROL SYSTEM BASED ON POLYVINYL ACETATE LATEX Final Report
D. F. Anderson, J. A. Durante, and L. H. Wartman Oct. 1971 57 p
(Contract DACA39-70-C-0011)
(AD-732484; AEWES-CR-S-71-9) Avail: NTIS CSCL 11/9

While dusting and the formation of dust clouds have always been significant factors in military operations, the advent of modern large-scale airborne tactics has transformed what was once primarily an annoyance to a costly and serious problem because dust ingestion into moving parts of aircraft accelerates wear, resulting in increased maintenance time and reduced operational availability. One of the systems developed to control dust employs DCA-70, a commercial commercial dust-control agent. The DCA-70 is sprayed on a graded soil surface where it forms a continuous film, anchored to the substrate, with good resistance to damage by air blasts and vehicular traffic. DCA-70 is a polyvinyl acetate latex compounded with dibutyl phthalate at a concentration of 10% of the contained solids in the latex. The dibutyl phthalate acts as a plasticizer, making films cast from the latex more pliable and resistant to rupture. However, because the dibutyl phthalate is quite volatile, it evaporates in hot climates resulting in decreased resiliency and strength. Thus more than thirteen plasticizers were tested for compatibility with the polyvinyl acetate latex used in the manufacture of DCA-70. Nine specification test methods, most of which are standard ASTM procedures for latex products, were applied to various commercial polyvinyl acetate latexes after addition of plasticizers using the formulations developed. The tests used are tensile properties of films, total solids, surface tension, pH, viscosity, filterable solids, salt tolerance, storage stability at 140F., and shear stability. GRA

N72-17551# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF A WATER-SOLUBLE SODIUM SILICATE FOAM FOR FRAGMENT RETRIEVAL Final Report
Richard A. Owen Oct. 1971 25 p
(Contract DAAD05-69-C-0466; DA Proj. 1T0-61102-A-33-E)
(AD-732852; BRL-CR-55; Rept-02-2648) Avail: NTIS CSCL 11/9

A new recovery material for use in fragmentation studies is described. The material, a sodium silicate foam, is water soluble which greatly facilitates fragment retrieval. Also, the material can be produced in any desired shape, on site, thereby reducing handling problems. The material can also be produced in a wide range of densities and other applications are suggested. Results are presented that show the foamed sodium silicate substantially reduces secondary breakup of long slender fragments produced by thin wall shells. A cost comparison of the sodium silicate foam with fiberboard for a 105mm panel test is presented.
Author (GRA)

N72-17678*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
IRRADIATION EFFECTS STUDIES OF NERVA MATERIALS
J. A. DeMastry and T. P. Merrick *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 595-602 Sponsored by AEC and NASA
Prepared for Aerojet Nucl. Systems Co. (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 11D

N72-17474# Colorado State Univ., Fort Collins.
INVESTIGATION OF CUMULATIVE EFFECTS IN MICROSCOPICALLY DAMAGED QUARTZ
David F. Edwards, C. Y. She, and V. G. Draggoo *In* NBS Damage in Laser Mater. Nov. 1971 p 24-30 refs Sponsored in part by AFCRL (See N72-17470 08-16)
Avail: SOD $1.50 as C13.10:356

N72-17477# Hughes Research Labs., Malibu, Calif.
TIME EVOLUTION OF DAMAGE TRACKS IN SAPPHIRE AND RUBY
Concetto R. Giuliano *In* NBS Damage in Laser Mater. Nov. 1971 p 44-50 refs (See N72-17470 08-16)
(ARPA Order 1434)
Avail: SOD $1.50 as C13.10:356

N72-17481*# GTE Sylvania, Inc., Mountain View, Calif.
OPTICALLY-INDUCED PHYSICAL DAMAGE TO LiNbO3, PROUSTITE, AND LiIO3
Wm. D. Fountain, L. M. Osterink, and G. A. Massey *In* NBS Damage in Laser Mater. Nov. 1971 p 91-97 refs (See N72-17470 08-16)
(Contract NAS12-2239; F08606-69-C-0054; N62269-69-C-0029; n00014-70-C-0224)
(NASA-CR-125567) Avail: NTIS; SOD $1.50 as C13.10:356 CSCL 11D

N72-17487# Perkin-Elmer Corp., Norwalk, Conn.
AN INVESTIGATION OF LASER INDUCED DAMAGE TO FOUR DIFFERENT SINGLE PURPOSE ANTI-REFLECTION

COATINGS ON FUSED SILICA SUBSTRATES
R. Russel Austin (AFWL, Kirtland AFB, N. Mex.) and Arthur H. Guenther *In* NBS Damage in Laser Mater. Nov. 1971 p 137-152 refs (See N72-17470 08-16)
Avail: SOD $1.50 as C13.10:356

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N72-17552*# North Carolina State Univ., Raleigh.
BOUNDED STATE VARIABLES AND THE CALCULUS OF VARIATIONS
Lawrence M. Hanafy Washington NASA Feb. 1972 19 p refs
(Grant NGL-34-002-032)
(NASA-CR-1984) Avail: NTIS CSCL 12A

An optimal control problem with bounded state variables is transformed into a Lagrange problem by means of differentiable mappings which take some Euclidean space onto the control and state regions. Whereas all such mappings lead to a Lagrange problem, it is shown that only those which are defined as acceptable pairs of transformations are suitable in the sense that solutions to the transformed Lagrange problem will lead to solutions to the original bounded state problem and vice versa. In particular, an acceptable pair of transformations is exhibited for the case when the control and state regions are right parallelepipeds. Finally, a description of the necessary conditions for the bounded state problem which were obtained by this method is given. Author

N72-17553# Joint Publications Research Service, Washington, D.C.
AXIOMATIC APPROACH TO A THEORY OF LOGIC-DYNAMIC CONTROL SYSTEMS
K. D. Zhuk 4 Feb. 1972 14 p refs Transl. into ENGLISH from Avtomatika (Kiev), no. 5, 1971 p 3-13
(JPRS-55105) Avail: NTIS

Axiomatic definitions are determined for the integration of a dynamic differential system and an abstract automaton into a single model of the functioning of a logic dynamic system. The properties of the basic model elements are: inputs, outputs, states, transitions, trajectories, transition paths, etc. G.G.

N72-17554# Joint Publications Research Service, Washington, D.C.
ANALYTICAL SYNTHESIS OF NONLINEAR CONTROLLER FOR SYSTEMS OF THE THIRD ORDER
O. S. Yakovlev 4 Feb. 1972 11 p refs Transl. into ENGLISH from Avtomatika (Kiev), no. 5, 1971 p 14-22
(JPRS-55106) Avail: NTIS

A system of differential equations of disturbed motion is examined by defining the continuous functions for a certain region of space with all time values to satisfy the Lipschitz conditions for variables. A law of control is formulated whereby zero solutions of a system of equations are stable or asymptotically stable. G.G.

N72-17555# Los Alamos Scientific Lab., N.Mex.
BOUNDS ON THE BANDWIDTH OF BIPARTITE GRAPHS
Robert R. Korfhage Sep. 1971 5 p refs
(Contract W-7405-Eng-36)
(LA-4744) Avail: NTIS

The bandwidth of a graph is defined, and determined for K sub m,n and for all bipartite graphs on 2+n vertices. For all other bipartite graphs, upper and lower bounds for the bandwidth are given. The relation between this work and the bandwidth of sparse matrices is pointed out. Author

N72-17556# Argonne National Lab., Ill. Applied Mathematics Div.
NUMERICAL SOLUTION OF THE ORR-SOMMERFIELD EQUATION AT LARGE REYNOLDS NUMBER
Thomas H. Hughes Sep. 1971 36 p refs
(Contract W-31-109-eng-38)
(ANL-7855) Avail: NTIS

The use of an automatically-determined variable mesh in the numerical solution of the Orr-Sommerfield equation is explored for plane Poiseuille flow. The usual finite-difference matrix method with a modified eigenvalue-search-procedure is used. The method is applicable at both small and very large Reynolds numbers and is used to piece together existing numerical and asymptotic results. The curve of neutral stability and several eigenfunctions are presented for plane Poiseuille flow. It is also demonstrated that the kink in the neutral curve is a feature of the Orr-Sommerfield equation and not just a deficiency in the asymptotic methods as previously suggested. Author

N72-17557# California Univ., Los Angeles. School of Engineering and Applied Science.
DISTRIBUTED PARAMETER SYSTEMS. AN ANNOTATED BIBLIOGRAPHY TO APRIL 1971, PARTS 1 AND 2
Lennart Johnsson Aug. 1971 208 p refs Sponsored in part by Allmanna Svenska Elektriska Aktiebolaget, Vasteras, Sweden
(Grant AF-AFOSR-1547-68; AF Proj. 9749)
(AD-732931; UCLA-ENG-7143; AFOSR-71-2952TR) Avail: NTIS CSCL 12/1

In the two part report a survey of methods for analysis and synthesis of distributed parameter systems is given. A few applications are also mentioned. Since the results are scattered throughout the literature and no unifying treatment is available the more essential results in different areas are stated without proof. Therefore, this report can be used as a reference for straightforward applications. The following subjects are treated in part one of the report: stability, controllability, observability, necessary and sufficient conditions for optimality and existence and uniqueness of solutions to some optimal control problems. In Part 2 stochastic control, identification, estimation, computational and synthesis methods and some applications, such as control of chemical reactors, heat exchangers, furnaces, nuclear rockets and plasmas are treated. Author (GRA)

N72-17410# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
COMMENTS ON LEAST-SQUARES ADJUSTMENTS OF THE CONSTANTS
B. N. Taylor *In its* Prec. Meas. and Fundamental Constants Aug. 1971 p 495-498 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 10.13:343

N72-17411# North American Rockwell Corp., Thousand Oaks, Calif. Science Center.
IN DEFENSE OF LEAST-SQUARES ADJUSTMENTS
E. Richard Cohen *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 499-501 ref (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17412# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
SOME ASPECTS OF LEAST-SQUARES ADJUSTMENTS OF CONSTANTS
John S. Thomsen *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 503-505 (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17414# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
CONTRIBUTION TO PANEL DISCUSSION ON

ADJUSTMENTS OF THE FUNDAMENTAL CONSTANTS
Churchill Eisenhart *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 509-525 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17878*# Translation Consultants, Ltd., Arlington, Va.
ON THE PROBLEM OF THE SMOOTHING OF CLOCK CORRECTIONS
A. N. Kuryanova *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 79-85 refs (See N72-17874 08-30)
Avail: NTIS CSCL 12A

N72-17888*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.
NONSTATIONARY ENVELOPE PROCESS AND FIRST EXCURSION PROBABILITY
J.-N. Yang *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 1-12 refs (See N72-17887 08-30)
Avail: NTIS CSCL 12A

N72-17478# California Univ., Los Angeles.
THEORY OF SELF-FOCUSING FOR FAST NONLINEAR RESPONSE
J. Marburger *In* NBS Damage in Laser Mater. Nov. 1971 p 51-60 refs (See N72-17470 08-16)
(Contract F44620-71-C-0067)
Avail: SOD $1.50 as C13.10:356

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N72-17558*# National Aeronautics and Space Administration, Washington, D.C.
EXAMETNET: THE FIRST FIVE YEARS, 1966 - 1970
1972 58 p refs
(NASA-SP-293) Avail: NTIS CSCL 04B

An assessment of the first five years of operation of the Experimental InterAmerican Meterological Rocket Network is presented. The formation of the network, and international and national relations are described. The technology and data procedures and techniques are reported, and their improvements and the research accomplished as a result of the cooperative effort among Argentina, Brazil, and the United States are discussed. Author

N72-17559# National Oceanic and Atmospheric Administration, Rockville, Md.
PLAN TO IMPROVE LOCAL WEATHER FORECASTS
Mar. 1971 46 p
(NOAA-NPP-71-2) Avail: NTIS

The plan to improve the public weather services for the zero- to six-hour forecasts of significant weather conditions is reported. The plan includes the activition of an operational field test facility for developing, evaluating, and testing observation measurement systems, local forecasting techniques, and services to user groups. Other aspects discussed include actions that can be accomplished without field testing or futher research and development, actions that are within the state of the art but which require field testing before implementation, research and development required to improve the present state of the art, and training and manpower. The allocation of resources is also discussed. F.O.S.

N72-17560*# National Aeronautics and Space Administration, Washington, D.C.
WORLD WEATHER PROGRAM: PLAN FOR FISCAL YEAR 1972
Apr. 1971 35 p Presented by President Richard Nixon to the Congr. of the US, Apr. 1971 Prepared jointly by Com. Dept, Defense Dept., State Dept., Transportation Dept., Environ. Protection Agency, AEC, NASA, and NSF
(NASA-TM-X-67561) Avail: NTIS; SOD $0.50 CSCL 04B

The World Weather Program which is composed of the World Weather Watch, the Global Atmospheric Research Program, and the Systems Design and Technological Development Program is presented. The U.S. effort for improving the national weather services through advances in science, technology and expanded international cooperation during FY 72 are described. The activities of the global Atmospheric Research Program for last year are highlighted and fiscal summary of U.S. programs is included. F.O.S.

N72-17561# National Oceanic and Atmospheric Administration, Washington, D.C.
FEDERAL PLAN FOR A NATIONAL AGRICULTURAL WEATHER SERVICE
Jan. 1971 36 p
(FCM-71-2) Avail: SOD $0.40

The plan to improve and expand existing agricultural weather services is presented. The planned service includes: (1) collection, analysis, and interpretation of weather data pertinent to optimum planning of the allocation of agricultural land, labor, and capitol; (2) technical studies in agriculture-weather relationships at one or more Federal and State Agricultural Experiment Stations in each State aimed at future improvements in weather service; (3) agricultural weather forecasts designed to support specific types and phases of farm operations, including processing and marketing decisions; and (4) rapid and efficient dissemination of forecasts, warnings, outlooks, and advisories. The role of federal agenices, users requirements, data collection, and dissemination are discussed. F.O.S.

N72-17562# Israel Program for Scientific Translations, Ltd., Jerusalem.
PROBLEMS OF SATELLITE METEOROLOGY
I. P. Vetlov and G. I. Morskoi, eds. 1970 102 p refs Transl. into ENGLISH of Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), no. 36, 1968 Sponsored by ESSA and NSF
(IPST-5669; TT-70-50001) Avail: NTIS

The processing, interpretation, and use of data collected by meteorological satellites for weather analysis and prediction is presented. Synoptic and dynamic meteorological methods as well as hydrometeorological applications are considered. For individual titles, see N72-17563 through N72-17573.

N72-17563# Israel Program for Scientific Translations, Ltd., Jerusalem.
USE OF CLOUD DATA OBTAINED BY METEOROLOGICAL SATELLITES FOR AN OBJECTIVE ANALYSIS OF THE WIND FIELD
L. A. Anekeeva *In its* Probl. of Satellite Meteorol. 1970 p 1-6 refs (See N72-17562 08-20)
Avail: NTIS

The interrelationship between cloud fields shown by satellite television, and air currents in the presence of cloud vortices is examined. Quantitative estimates are made of the angle between the direction of the cloud band forming the vortex and the wind direction in the same regions. The vortices are compared by means of a relative coordinate system and relative linear dimensions, on the assumption that the shape of cloud spirals is near-hyperbolic. The region occupied by the cloud vortex is divided into 40 parts for each of which histograms of the distribution of angle between the cloud-band direction and the wind direction at a station are constructed. The most probable values obtained for each cloud vortex segment make it possible to determine the wind direction at any point of the cloud-vortex

region. The relationships obtained in the above manner are used to calculate the wind field by means of an objective analysis, using polynomial interpolation. Author

N72-17564# Israel Program for Scientific Translations, Ltd., Jerusalem.
DETERMINATION OF THE JET-STREAM AXIS FROM SATELLITE CLOUD DATA
T. D. Dzyubenko and A. M. Tsarkova *In its* Probl. of Satellite Meteorol. 1970 p 7-12 refs (See N72-17562 08-20)
Avail: NTIS

The possibility is examined of determining the location of a jet stream axis from properties of the cloud field, the mutual location of the cloud cover and the jet stream axis. The average wind velocities and horizontal wind gradients along and perpendicular to the axis were determined at jet stream sections from television pictures of cloudiness. It is noted that jet stream segments located in the forward part of the altitudinal trough are most frequently surveyed on TV pictures. The cloud mass of the jet stream is located primarily on the warm side and its boundary facing the cold side in 72% of the cases coincides with the jet stream axis. The mean velocity at characteristic points of the jet stream axis ranges from 44 to 52 m/sec; the wind shear in the direction perpendicular to the jet stream axis is 7.6 m/sec from the cold side and 6.2 m/sec from the warm side per 100km. Author

N72-17565# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE CLOUDINESS STRUCTURE IN CYCLONES IN SOUTHERN EUROPEAN USSR FROM SATELLITE PHOTOGRAPHS
T. P. Popova *In its* Probl. of Satellite Meteorol. 1970 p 13-19 refs (See N72-17562 08-20)
Avail: NTIS

The cloud field structure determined by air motion parameters can yield indirect indications of atmospheric processes. Considered were structural features of the cloud field from television photographs taken by a satellite, which are characteristic of cyclones forming over southern European USSR. Author

N72-17566# Israel Program for Scientific Translations, Ltd., Jerusalem.
SHADOW ON SATELLITE PHOTOGRAPHS AS A SOURCE OF INFORMATION ON THE HEIGHT OF CLOUDS
M. Nazirov *In its* Prob. of Satellite Meteorol. 1970 p 20-25 (See N72-17562 08-20)
Avail: NTIS

Before the shadow on satellite photographs can be used to determine the vertical extent of clouds, correction factors, which depend on the distance between the shadow on the picture and the sub-satellite point during photography, must be introduced. Such an adjusted shadow width, together with the calculated elevation of the sun in the region of the shadow, are used to graphically determine the height of cirrus cloud bands on a picture obtained from the Cosmos 206 satellite. Author

N72-17567# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE INTERTROPICAL CONVERGENCE ZONE IN THE EASTERN PACIFIC FROM METEOROLOGICAL SATELLITE OBSERVATIONS
I. A. Alekseeva *In its* Probl. of Satellite Meteorol. 1970 p 26-34 refs (See N72-17562 08-20)
Avail: NTIS

The spatial structure of the cloud field in the eastern part of the tropical Pacific is examined with the aid of satellite observations during 1967. The possibility is considered of identifying the intertropical convergence zone with cloud fields. The position of this zone is given according to months. In the Northern Hemisphere it is quite stable throughout the year. In the Southern Hemisphere, from mid-February to May, one observes an ITC zone with a branch extending to the north of the equator. Consideration is given to the internal structure of the ITC zone, i.e., its cellular structure, characteristic horizontal dimensions, and space and time variations. It is shown that meteorological satellite information, which is continuous in space, is an important supplement when analyzing atmospheric processes in tropical latitudes. Author

N72-17568# Israel Program for Scientific Translations, Ltd., Jerusalem.
FEATURES OF THE ATMOSPHERIC FRONTS IN THE SOUTHERN HEMISPHERE FROM SATELLITE OBSERVATIONS
I. R. Egorova *In its* Probl. of Satellite Meteorol. 1970 p 35-38 refs (See N72-17562 08-20)
Avail: NTIS

Some features are considered of fronts in the South Pacific for March-April 1967 using satellite radiation data. Average and extremal values are presented of the radiation characteristics in the region of the front for two latitudinal belts (27-45 deg and 45-60 deg S) and for a number of specific frontal zones. Zones with reduced radiation temperatures in the given region, which is about 650 km wide, often occur. The mean rates of their motion at low and high altitudes are given. The presence of intensive transport of air masses between latitudes in the 150-160 W region is confirmed. It is shown that the relative intensities of frontal interfaces can be determined from radiation characteristics. Author

N72-17569# Israel Program for Scientific Translations, Ltd., Jerusalem.
RELATIONSHIP BETWEEN CLOUD MASSES OBSERVED FROM A SATELLITE AND THEIR PRECIPITATION ZONES
E. P. Dombkovskaya *In its* Probl. of Satellite Meteorol. 1970 p 39-45 refs (See N72-17562 08-20)
Avail: NTIS

A ground network of stations located far apart cannot provide data on the cloudiness distribution over regions where there are no stations. With the advent of meteorological satellites, the cloudiness distribution over these regions could also be studied. This paper presents the results of studies TIROS and TIROS data, and those obtained at ordinary meteorological stations. The available data show that, in general, precipitation originates from cloudiness, denoted on nephelometer charts as continuous. As a rule, precipitation zones occupy a relatively small proportion of cloud masses and are distinguished by a great time variability. A sufficiently close correlation exists between cloud-mass size and its precipitation zone. On the average, the larger the cloud mass, the smaller is the proportion occupied by the precipitation zone. Author

N72-17570# Israel Program for Scientific Translations, Ltd., Jerusalem.
USE OF METEOROLOGICAL-SATELLITE DATA AS A NAVIGATION AID c21
K. P. Vasilev *In its* Probl. of Satellite Meteorol. 1970 p 46-57 refs (See N72-17562 08-20)
Avail: NTIS

The use of satellite data as a navigation aid is considered, and methods for interpreting satellite television pictures of sea ice are described. The significance of climatic data in interpreting satellite photographs and the establishment of ice charts from satellite photographs are discussed. An example is presented of supplying ice information, obtained from satellite data, to a survey vessel. The problem of selecting photographs of cloud vortices to determine zones of gale-force swells in the ocean as a function of the cyclone development stage is considered in detail. Author

N72-17571# Israel Program for Scientific Translations, Ltd., Jerusalem.
A QUALITATIVE ANALYSIS OF SATELLITE INFRARED

DATA c23
E. V. Dzyubenko and V. V. Puchkov *In its* Probl. of Satellite Meteorol. 1970 p 58-74 refs (See N72-17562 08-20)
Avail: NTIS

The possibility of determining the radiating surface temperature and altitude of an upper cloud boundary using infrared equipment of Meteor satellites is considered. The effect of water vapor and ozone on outgoing radiation at the 8-12 micron atmospheric window is studied qualitatively. Relationships are obtained for the deviation of the radiation temperature from the actual temperature of radiating surfaces located at altitudes of 0, 2, 4, 6 and 8 km. Calculations based on experimental data show that, using satellite infrared equipment, the underlying-surface temperature can be determined to within 1.5-2.0 deg and the altitude of the upper cloud boundary to within 1.0-1.5 km. It is pointed out that a quantitative analysis of infrared information from Meteor satellites can be carried out in operative times. Author

N72-17572# Israel Program for Scientific Translations, Ltd., Jerusalem.
CORRELATION FUNCTIONS AND SPECTRAL DENSITIES OF THE INTENSITY OF OUTGOING RADIATION OVER THE SPECTRAL RANGE 0.6-0.8 MICRONS (FROM MEASUREMENTS OF THE COSMOS-45 SATELLITE) c24
V. G. Boldyrev, D. M. Sonechkin, V. I. Tulupov, and I. S. Khandurova *In its* Probl. of Satellite Meteorol. 1970 p 75-80 refs (See N72-17562 08-20)
Avail: NTIS

Results are presented of calculations of autocorrelation functions and spectral densities of reflected radiation over the spectral range 0.6-0.8 micron. The calculations are based on measurements obtained from the Cosmos 45 satellite, which used nonscanning, narrow-viewing angle apparatus with its sensor directed into the nadir. The effects on the instrument readings of changes in illumination were eliminated by the use of moving averages. The results confirm the presence of a deep, mesoscale minimum in the spatial spectrum of reflected radiation, and of a maximum corresponding to the characteristic dimension of synoptic formations (cyclones and anticyclones). Author

N72-17573# Israel Program for Scientific Translations, Ltd., Jerusalem.
ANALYSIS OF STUDIES OF LARGE-SCALE VERTICAL MOTIONS IN THE ATMOSPHERE
G. I. Morskoi *In its* Probl. of Satellite Meteorol. 1970 p 81-101 refs (See N72-17562 08-20)
Avail: NTIS

The development of satellite meteorology as a new branch of the meteorological sciences is closely related to the determination of large scale vertical velocities. Vertical velocities are not actually measured and many methods have been developed for their calculation, often yielding different results. The present survey is an overdue first attempt at a comparative evaluation and systematization of these methods. Studied are 200 works and an attempt is made to classify them. Author

N72-17574# Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany).
ATMOSPHERIC AEROSOLS BETWEEN 700 AND 3000 METERS ABOVE SEA LEVEL. PART V: A STUDY OF THE EFFECTS OF ATMOSPHERIC FINE STRUCTURE CHARACTERISTICS ON THE VERTICAL DISTRIBUTION OF AEROSOLS
Reinhold Reiter, Rudolf Sladkovic, and Walter Carnuth Jul. 1971 158 p refs
(Contract DAJA37-70-C-2647; DA Proj. 1T0-61102-B-53-A)
(AD-732877) Avail: NTIS CSCL 04/1

The objectives were: (a) To shield the cable car telemetry systems against all effects of the weather and to obtain by them homogeneous series of recordings; (b) to develop and apply the physical and mathematical bases for the complete numeric evaluation of the recording runs, up to and including computation of the incremental exchange coefficients; (c) to continually record at the three stations the Aitken nuclei concentrations, natural radioactivity (RaB, RaC), and polar conductivities, and to utilize them in the evaluations; and (d) to derive initial deductions from the results. A new computer (Intertechnique Multi 8) with 12 K words (1 word = 9 bit) affords the possibility to perform the entirety of all computation processes in one single operation, and to print them out in tables. Author (GRA)

N72-17575*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIR QUALITY AEROMETRIC DATA FOR THE CITY OF CLEVELAND FROM 1967 TO 1970 FOR SULPHUR DIOXIDE, SUSPENDED PARTICULATES, AND NITROGEN DIOXIDE
Harold E. Neustadter, Robert B. King, J. Stuart Fordyce, and John C. Burr, Jr. Washington Mar. 1972 54 p refs
(NASA-TM-X-2496; E-6635) Avail: NTIS CSCL 04B

The NASA Lewis Research Center is assisting the City of Cleveland, Ohio, in its effort to monitor its air pollution. This report describes the Cleveland program of the past 4 years and the supportive Lewis program currently being developed. The data accumulated by Cleveland over the past 4 years are presented together with some preliminary statistical analyses indicating in a semiquantitive manner the degree of air pollution existing within the boundaries of Cleveland. Author

N72-17576# Stanford Univ., Calif. Dept. of Civil Engineering.
ENERGY AND MASS TRANSFER THROUGH AN AIR-WATER INTERFACE
Peter A. Mangarella, A. John Chambers, Robert L. Street, and En Yun Hsu May 1971 192 p refs
(Grant NSF GA-1471)
(PB-202458; SU-TR-134) Avail: NTIS CSCL 04B

The mechanisms governing energy and mass transfer through a wavy air-water interface over which a turbulent wind is blowing are studied. Energy and mass flux through the interface was determined by applying conservation of energy and mass in the integral equation form to the flow over the waves. Normalized temperature and concentration profiles were found to be almost identical for a given fetch and wind speed. Normalized energy and mass transfer were expressed as Stanton numbers. The interface temperature was determined by remote sensing using an infrared radiometer. The bulk-interface temperature difference was proportional to the measured total energy transfer through the interface. Author (GRA)

N72-17577# Stanford Research Inst., Menlo Park, Calif.
ESTIMATION OF PRECIPITATION OVER FLATHEAD DRAINAGE BASIN USING METEOROLOGICAL SATELLITE PHOTOGRAPHS
Paul A. Davis, Eldon J. Wiegman, and Sidney M. Serebreny Oct. 1971 56 p
(Contract DI-14-06-D-7047; SRI Proj. 8901)
(PB-204446; REC-14-06-D-7047-F) Avail: NTIS CSCL 04B

A series of once-per-day satellite photographs of cloudiness during a fall and early winter period of 1968 and a spring and early summer period of 1969 were used to estimate total precipitation over the Flathead River drainage basin. Eight representative categories of cloud cover were distinguished in terms of their probable contribution to basin precipitation. Summations of the probable precipitation amounts associated with the cloud categorizations provided on estimate of the total basin precipitation for all the days examined. Author (GRA)

N72-17578# Atmospherics, Inc., Fresno, Calif.
PROJECT ARID DROP: A SUMMARY REPORT OF CLOUD SEEDING ACTIVITIES CONDUCTED IN ARIZONA Final Report, 16 Jul. - 12 Aug. 1971
Thomas J. Henderson and William J. Carley Oct. 1971 19 p
(Contract DI-14-06-D-7185)
(PB-204604; REC-14-06-D-7185-S) Avail: NTIS CSCL 04B

A summary of aerial application of silver iodide to convective cumulus developments is presented. The before-during-after observations of seeded and nonseeded single cumulus cells in the moderate development category indicated a significant measure of success. Results from treatment of small cumulus cells in an area where none were left untreated produced precipitation on the ground from about half of the treated cells, while the remaining cells produced only virga or no precipitation. Further observations indicated proper treatment of cumulus clouds initiated precipitation, and enhanced the total rainfall from clouds where precipitation was already in progress.
Author (GRA)

N72-17579# Federal Aviation Administration, Washington, D.C.
FAA SYMPOSIUM ON TURBULENCE Final Report
24 Mar. 1971 116 p Symp. held at Washington, D. C., 22-24 Mar. 1971
(AD-732117) Avail: NTIS CSCL 04/1

The symposium covered wake turbulence, clear air turbulence, wind shear, upsets, thunderstorms, and turbulence plotting. Presentations were given by experts from the academic community, airlines, and government organizations, ranging from reports of tests made on aircraft wake turbulence to scientific studies of the turbulence in the atomosphere and ways of transmitting turbulence information to pilots. The final report of the symposium includes a summary of each presentation.
Author (GRA)

N72-17580# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: JAPANESE AND KOREAN COASTAL MARINE AREAS. VOLUME 9: AREA 25, KANGNUNG, AREA 26, PUSAN, AREA 27, CHEJU ISLAND
Sep. 1971 484 p
(AD-732758) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The report covers the following areas: Kangnung; Pusan; Cheju Island. Author (GRA)

N72-17581# Naval Weapons Center, China Lake, Calif. Research Dept.
PROPERTIES OF AMMONIUM NITRATE-UREA-WATER HYGROSCOPIC REAGENT FOR WARMER FOGS
Richard S. Clark, Lohr A. Burkadt, and John W. Carroz Oct. 1971 33 p refs
(AD-732757; NWC-TP-5190) Avail: NTIS CSCL 04/2

When used together, large quantities of ammonium nitrate and urea may be added to small amounts of water to form a liquid possessing useful properties for fog dispersal purposes. The properties of this liquid are reported. The properties included are hygroscopicity, availability, cost, handling, ecological effects, chemical properties, and drop growth. The liquid provides a satisfactory balance of desirable properties for fog dispersal.
Author (GRA)

N72-17582# Texas A&M Univ., College Station. Water Resources Inst.
APPLICATIONS OF CLIMATOLOGY AND METEOROLOGY TO HYDROLOGIC SIMULATION
Robert A. Clark and Gary E. OConnor Jun. 1971 139 p refs
(Contract DI-14-31-0001-3244; OWRR Proj. A-016-TEX)
(PB-202982; W71-13150; TR-38) Avail: NTIS CSCL 08H

The primary goal of this investigation was to test hydrometeorological data for suitable probability distributions. The interrelationships between various types of data were investigated also. In particular, the reliability of records which were collected over variable periods and the ability of selected distributions to synthesize hydrometeorological data. Statistical tests were employed to determine the suitability of the tested data for use in a model which employs the Markov process.
Author (GRA)

N72-17583# Arizona Univ., Tucson. Inst. of Atmospheric Physics.
OBSERVED DOPPLER SPECTRA OF HAIL
Louis J. Battan and John B. Theiss 15 Jun. 1971 28 p refs
(Grants NSF GA-1431; NSF GA-24134)
(PB-203254; UA-IAP-SR-71-25) Avail: NTIS CSCL 04B

Observations of Doppler spectra from particles 610 m above the ground were obtained by means of a vertically pointing X-band radar during a perioJ when large hail was falling at the ground. It was found that the variance of the Doppler spectrum was a fairly good indicator of maximum hailstone sizes. Calculations of ice-particle size spectra were made on the basis of assumptions of particle shape, composition and fall speed. The many assumptions needed to bring calculated ice-sphere spectra into approximate conformity with observations indicates the complexity of this procedure and the need for at least one more independent observation of the properties of the hailstones. Measurements of depolarization might yield as independent estimate of particle shape. It is concluded that the pronounced minima in the backscattering curves of large ice spheres should serve as an independent indicator of the speed of vertical air motions.
Author (GRA)

N72-17584# RAND Corp., Santa Monica, Calif.
SUGGESTIONS (RESURRECTED) FOR THE IMPROVEMENT OF SHORT RANGE WEATHER FORECASTING
R. E. Huschke Mar. 1971 13 p
(AD-732678; P-4580) Avail: NTIS CSCL 04/2

Five basic aspects of the forecast problem are discussed and suggestions made. The aspects covered are the nature of the ideal forecast and forecasting technique, the problem of specification, the factor of human talent, and the recognition of customer needs.
Author (GRA)

N72-17585# RAND Corp., Santa Monica, Calif. Dept. of Environmental Sciences.
SIMULATION OF WEATHER SENSITIVE MILITARY OPERATIONS
Ralph E. Huschke Apr. 1971 17 p Presented at the 1970 Meteorol. Tech. Exchange Conf. 1970, Annapolis, 21-24 Sep. 1970
(AD-732624; P-4487) Avail: NTIS CSCL 04/2

Based on, and illustrated by, experience in designing a computer model of a weather-sensitive STRICOM operation, a set of guidelines is suggested for building simulation models of military operations for the purpose of quantifying the value of weather services. Results from the STRICOM model are presented as an argument supporting the desirability for the weather services to engage in this kind of analysis.
Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N72-17586 Utah Univ., Salt Lake City.
DESIGN OF MISSILE FLIGHT TESTS IN TERMS OF ESTIMATION ERRORS DERIVED FROM RADAR DATA Ph.D. Thesis
George Elmer Parker 1970 112 p
Avail: Univ. Microfilms Order No. 70-23071

The problem of evaluation of the inertial guidance system of

a ballistic missile is discussed. Precision radar systems were used to observe the missile during powered flight. The position of the missile as observed by the radar was compared with the position measured by the inertial guidance system. Differences in the two positions were considered as caused by systematic errors in the inertial guidance system and the radar system. The radar data was corrected for systematic errors that could be measured. The corrected radar data was then used in a Kalman filter to estimate both the radar and inertial guidance system errors. The variance on the inertial guidance system errors was projected into a variance at impact of the missile payload. Considerations that must be applied when using the Kalman filter on a practical problem, and some rather weak conditions for convergence of the filter when it is used to estimate the state of a static system are also considered. Dissert. Abstr.

N72-17587*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONCEPTUAL DESIGN AND ANALYSIS OF AN INFARED HORIZON SENSOR WITH COMPENSATION FOR ATMOSPHERIC VARIABILITY
Antony Jalink, Jr., Richard E. Davis, and John A. Dodgen Washington Feb. 1972 33 p refs
(NASA-TN-D-6616; L-8013) Avail: NTIS CSCL 17G

A horizon detection logic, based on a ratio-of-integrated-radiance concept, which detects the earth's horizon at a relatively stable height under all geographic and meteorological conditions was evaluated by computer simulation on a body of synthesized radiance profiles. An error-sensitivity analysis of the concept was performed, and optimum design parameter values for a sensor were determined. A conceptual design for an improved 15 micron sensor based on this analysis is discussed. Author

N72-17588*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STABILIZING A SPINNING SKYLAB
S. M. Seltzer, Jayant S. Patel (Teledyne Brown Engineering), D. W. Justice, and Gerhard Schweitzer 3 Jan. 1972 9 p refs Sponsored in part by NRC
(NASA-TM-X-64635) Avail: NTIS CSCL 22B

The results are presented of a study of the dynamics of a spinning Skylab space station. The stability of motion of several simplified models with flexible appendages was investigated. A digital simulation model that more accurately portrays the complex Skylab vehicle is described, and simulation results are compared with analytically derived results. Author

N72-17589*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON AND EVALUATION OF SATELLITE DERIVED POSITIONS OF TRACKING STATIONS
Samir F. Vincent (Computer Sci. Corp.), William E. Strange (Computer Sci. Corp.), and James G. Marsh Jun. 1971 51 p refs Presented at Fall Meeting of the Am. Geophys. Union, Dec. 1970
(NASA-TM-X-65814; X-553-71-257) Avail: NTIS CSCL 17G

A comparison is presented of sets of satellite tracking station coordinate values published in the past few years by a number of investigators, i.e. Goddard Space Flight Center, Smithsonian Astrophysical Observatory, Ohio State University, The Naval Weapons Laboratory, Air Force Cambridge Research Laboratories, and Wallops Island. The comparisons have been made in terms of latitude, longitude and height. The results of the various solutions have been compared directly and also with external standards such as local survey data and gravimetrically derived geoid heights. After taking into account systematic rotations, latitude and longitude agreement on a global basis is generally 15 meters or better, on the North American Datum agreement is generally better than 10 meters. Allowing for scale differences (of the order of 2 ppm) radial agreement is generally of the order of 10 meters. Author

N72-17590*# Translation Consultants, Ltd., Arlington, Va.
THE USE OF THE AIRGLOW LAYER EFFECT FOR AUTONOMOUS NAVIGATION AND ORIENTATION OF MANNED SPACECRAFT
K. Ya. Kondratyev, N. F. Romanteyev, O. I. Smoktiy, and Ye. V. Khrunov Washington NASA Feb. 1972 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, (Moscow) v. 199, no. 6, 1971 p 1278-1281
(Contract NASw-2038)
(NASA-TT-F-14110) Avail: NTIS CSCL 17G

The airglow layer observed by the spacecraft Soyuz 5 is described. The use of the airglow layer for navigational purposes is postulated on the basis of Soyuz 5, Soyuz 9, and rocket measurements. Author

N72-17591*# Syracuse Univ., N.Y. Dept. of Mechanical and Aerospace Engineering.
THEORETICAL STUDY OF CORRUGATED PLATES: SHEAR STIFFNESS OF A TRAPEZOIDALLY CORRUGATED PLATE WITH DISCRETE ATTACHMENTS TO A RIGID FLANGE AT THE ENDS OF THE CORRUGATIONS
Chen-liau Hsiao and Charles Libove Washington NASA Feb. 1972 26 p refs
(Grant NGR-33-022-115)
(NASA-CR-1966; MAE-1833-T3) Avail: NTIS CSCL 20K

Analysis and numerical results are presented for the elastic shear stiffness of a corrugated shear web with a certain type of discrete attachments at the ends of the trough lines of the corrugations, namely point attachments to a rigid flange which interferes with the deformations of the end cross sections by preventing downward movement but permitting upward (lifting off) movement. The analysis is based on certain assumed modes of deformation of the cross sections in conjunction with the method of minimum total potential energy and the calculus of variations in order to obtain equations for the manner in which the assumed modes of deformation vary along the length of the corrugation. The numerical results are restricted to the case of equal-width crests and troughs but otherwise apply to a wide variety of geometries. They are in the form of graphs which give the overall shear stiffness as a fraction of the overall shear stiffness that could be obtained by having continuous attachment at the ends of the corrugations. Author

N72-17592# National Aviation Facilities Experimental Center, Atlantic City, N.J.
MEASUREMENT AND ANALYSIS OF EN ROUTE ATC DIGITAL RADAR SYSTEM ERRORS Interim Report, Jul. 1970 - Mar. 1971
Clifford Chapman Sep. 1971 26 p refs
(FAA Proj. 012-605-03(X))
(AD-730056; FAA-NA-71-16; FAA-RD-71-63) Avail: NTIS CSCL 17/7

Prior to the conduct of tests pertinent to radar separation standards, a review of previous efforts was accomplished to ascertain the application of existing data towards the establishment of separation criteria within the en route Air Traffic Control National Airspace System, Model 1 complex at Jacksonville, Florida. Data analyses and presentation were directed towards the range and azimuth resolution characteristics and aircraft-separation measurement capability of the secondary-radar/digitizer subsystem. Author(GRA)

N72-17593# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TASK 2, TEST AND EVALUATION OF A VOR SOLIDSTATE MODULATION ELIMINATOR REPLACEMENT Final Report, Mar. 1969 - Aug. 1971
Barry S. Brayer Sep. 1971 22 p
(FAA Proj. 042-307-05(X); FAA Proj. 330-011-05(X))
(AD-729733; FAA-NA-71-28; FAA-RD-71-66) Avail: NTIS CSCL 17/7

The report presents the results of tests conducted on a breadboard solid-state RF amplifier unit that was designed to

replace the power divider and modulation eliminator in a conventional VOR installation. The data obtained from tests on this equipment at the National Aviation Facilities Experimental Center (NAFEC) will be used to provide the basis for specifications of a prototype model. Author (GRA)

N72-17594# Federal Aviation Administration, Washington, D.C. Office of Systems Engineering Management.
TECHNICAL PROGRAM PLAN FOR HEADQUARTERS AIR TRAFFIC SERVICE AUTOMATION Final Report
Aug. 1971 130 p refs Prepared for presentation at US Intern. Transportation Exposition, Washington, D. C., 27 May - 4 Jun. 1972
(AD-731722; FAA-EM-71-2) Avail: NTIS CSCL 17/7

A technical program plan to automate certain headquarters air traffic service functions was developed. The plan recommended a method of automating operational functions concerned with the nationwide monitoring of the air traffic control system and the control of air traffic flows. Functional descriptions, data processing design and size estimates for a representative system, estimated development and operating costs, and a recommended development and implementation plan are contained in the document. Author (GRA)

N72-17595# National Aviation Facilities Experimental Center, Atlantic City, N.J.
INVESTIGATION OF A AIRBORNE MARKER BEACON Final Report, Jun. 1970 - Sep. 1971
Louis A. Dvorsky Nov. 1971 104 p
(FAA Proj. 341-004-03(X))
(AD-732312; FAA-NA-71-29; FAA-RD-71-80) Avail: NTIS CSCL 17/7

Ground and airborne tests of flight inspection marker beacon receiving system were made to identify and correct variations in marker pattern measurement from time to time and from aircraft to aircraft. The tests were made with both the T-29 Convair and DC-3 aircraft. Based on the flight test results, new receiver calibration and antenna system ramp calibration procedures were devised. Author (GRA)

N72-17596# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE EFFECT OF GRAVITY ON A LIQUID FILLED GYROSCOPE
William P. DAmico Mar. 1971 20 p refs
(RDT Proj. E-1T-061102-A-33-D)
(AD-732881; BRL-MR-2097-Rev) Avail: NTIS CSCL 17/7

The effect of gravity as a simple vertical body force was included in the steady state pressure distribution of a rapidly spinning liquid. For the simple case of a completely filled cylinder, the classical liquid-filled gyroscope stability problem was considered. Analysis showed that the liquid eigenfrequencies were identical to the Stewartson case and that a new, but second order, liquid moment term resulted. Author (GRA)

N72-17597# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
OPTIMAL AERODYNAMIC ATTITUDE STABILIZATION OF NEAR EARTH SATELLITES
Rangaswamy Ravindran Feb. 1971 137 p refs
(Grant AF-AFOSR-1490-68; AF Proj. 9749)
(AD-732930; UTIAS-164; AFOSR-71-2949TR) Avail: NTIS CSCL 22/3

A near Earth satellite orbiting in the altitude range of 15 km to 450 km encounters small but non-negligible aerodynamic forces. It is possible to generate sufficient aerodynamic torques by providing all-moving control surfaces of suitable size to achieve active attitude control. This report is a preliminary study of such an active attitude control system. The satellite configuration considered has four all-moving control surfaces and the dominant gravity gradient torques and aerodynamic torques are considered in the analysis. The resulting equations of motion are linearized and modern optimal control theory concepts are applied to synthesize a feedback control surface to obtain the necessary control torques. The numerical studies carried out indicate that it is possible to control a near Earth satellite by using control surfaces of reasonable size. Damping times of the order of from a few orbits to a fraction of an orbit seem reasonable. Author (GRA)

N72-17598# Lincoln Lab., Mass. Inst. of Tech., Lexington.
TECHNICAL DEVELOPMENT PLAN FOR A DISCRETE ADDRESS BEACON SYSTEM Final Report
Washington FAA Oct. 1971 111 p
(Contract DOT-FA71WAI-210; FAA Proj. 034-241-012)
(AD-732585; FAA-RD-71-79) Avail: NTIS CSCL 17/7

The requirement for a Discrete Address Beacon System (DABS) to provide improved surveillance and ground-air communications in support of air traffic control automation is discussed. A technical development plan for such a system is presented. The DABS technical development plan identifies the critical issues and technical options, presents a program for their resolution, followed by the development and test of a prototype model of the system, and describes the management structure to coordinate and carry out the many tasks involved in the implementation of the plan. Author (GRA)

N72-17599# National Aviation Facilities Experimental Center, Atlantic City, N.J.
MODELING AND ANALYSIS OF AIR TRAFFIC CONTROL VOICE COMMUNICATION CHANNEL LOADING Interim Report, May 1969 - May 1971
Allen C. Busch Nov. 1971 56 p
(FAA Proj. 012-604-01(X); FAA Proj. 187-601-01(X))
(AD-732619; FAA-NA-71-42; FAA-RD-71-78) Avail: NTIS CSCL 17/7

An effort to analyze and model by means of a nonreal-time simulation programming language, in this case GPSS, some of the characteristics of an air traffic control (ATC) air/ground/air voice communications channel is discussed. The functional entities or parameters are described. A comparison is made between the modeling outputs and real field derived measures of system output or performance. The conclusions are that this type of modeling and analysis can be a powerful and efficient tool for ATC simulation and system analysis provided that the model parameters adequately coincide with real system parameters and that real operational data are used to quantify the dependent and independent variables in the model. Author (GRA)

N72-17600# Unidynamics/Phoenix, Ariz.
CLASS 1 AIRPORT FLASHING BEACON Final Report
Arthur W. Mittendorf Nov. 1970 78 p
(Contract DOT-FA70WA-2229)
(AD-725016; FAA-RD-70-83) Avail: NTIS CSCL 17/7

Under FAA sponsorship, research and development was conducted to test and fabricate a prototype of a Class 1 flashing beacon. This strobe type beacon provides alternate green and white flashes at one of two selected rates, 12 or 24 flashes per minute. The flashers are evenly spaced at six green and six white or twelve green and twelve white. At the slow rate, the effective intensities of white and green flashes are in excess of 50,000 and 7,500 candelas respectively. A set of cylindrical Fresnel lenses for each of two xenon flash lamps provides an omni-directional beam ten degrees wide vertically. The beacon system utilizes a condenser discharge power supply and two-xenon flashlamps having an operational life in excess of three million flashes when operated at the six-flashes-perminute rate. The power supply consumes less than 3 KW and weighs approximately 250 pounds. Author (GRA)

N72-17901*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.
APPLICATION OF NEW RADIO TRACKING DATA TYPES TO CRITICAL SPACECRAFT NAVIGATION PROBLEMS

V. J. Ondrasik and K. H. Rourke *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 116-132 refs (See N72-17887 08-30)
Avail: NTIS CSCL 17G

N72-17570# Israel Program for Scientific Translations, Ltd., Jerusalem.
USE OF METEOROLOGICAL-SATELLITE DATA AS A NAVIGATION AID
K. P. Vasilev *In its* Probl. of Satellite Meteorol. 1970 p 46-57 refs (See N72-17562 08-20)
Avail: NTIS

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N72-17601*# National Aeronautics and Space Administration, Washington, D.C.
PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON NATURAL AND MANMADE RADIATION IN SPACE
E. A. Warman, ed. (Aerojet Nucl. Systems Co.) Jan. 1972 1035 p refs Proc. of the symp. held at Las Vegas, Nev., 1-5 Mar. 1971; sponsored by AEC and NASA
(NASA-TM-X-2440) Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

Interdisciplinary studies reported at this conference cover most aspects of radation in space with emphasis on space nuclear power and spacecraft nuclear propulsion systems. Radiobiological representations include extraterrestrial radiation dosage, detection, and shielding for spacecrews. For individual titles, see N72-17602 through N72-17733.

N72-17602*# Space Nuclear Systems Office (AEC/NASA), Washington, D.C.
SPACE NUCLEAR PROPULSION SYSTEMS AND APPLICATIONS
Francis C. Schwenk *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 2-12 ref (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18E

The basic principles of the operation of a nuclear rocket engine are reviewed along with a summary of the early history. In addition, the technology status in the nuclear rocket program for development of the flight-rated NERVA engine is described, and applications for this 75,000-pound thrust engine and the results of nuclear stage studies are presented. Advanced research and supporting technology activities in the nuclear rocket program are also summarized. Author

N72-17603*# Space Nuclear Systems Office (AEC/NASA), Washington, D.C.
SPACE NUCLEAR POWER SYSTEMS
R. T. Carpenter *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 13-25 (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18E

Space nuclear power systems are considered for use in those particular spacecraft applications for which nuclear power systems offer unique advantages over solar and/or chemical space power systems. Both isotopic and reactor heated space electrical power units are described in an attempt to illustrate their operating characteristics, spacecraft integration aspects, and factory-to-end of mission operational considerations. The status of technology developments in nuclear power systems is presented. Some projections of those technologies are made to form a basis for the applications of space nuclear power systems to be expected over the next 10-15 years. Author

N72-17604*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NUCLEAR APPLICATIONS IN MANNED SPACE STATION
W. A. Brooksbank, Jr. and G. J. Sieren *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 26-33 (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18L

The zirconium hydride reactor, coupled to a thermo-electric or Brayton conversion system, and the Pu 238 isotope/Brayton system, are considered to be the viable nuclear candidates for the modular space station electrical power system. The basic integration aspects of these nuclear electrical power systems are reviewed, including unique requirements imposed by the buildup and incremental utilization considerations of the modular station. Also treated are the various programmatic aspects of nuclear power system design and selection. Author

N72-17605*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
IMPACT OF RADIATION DOSE ON NUCLEAR SHUTTLE CONFIGURATION c31
C. A. Goetz and M. A. Billings *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 40-47 refs (See N72-17601 08-22)
(Contract NAS8-24714)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22B

The impact of nuclear radiation (from the NERVA propulsion system) on the selection of a reference configuration for each of two classes of the reusable nuclear shuttle is considered. One class was characterized by a single propellant tank, the shape of whose bottom was found to have a pronounced effect on crew radiation levels and associated shield weight requirements. A trade study of shield weight versus structural weight indicated that the minimum-weight configuration for this class had a tank bottom in the shape of a frustum of a 10 deg-half-angle cone. A hybrid version of this configuration was found to affect crew radiation levels in substantially the same manner. The other class of RNS consisted of a propulsion module and eight propellant modules. Radiation analyses of various module arrangements led to a design configuration with no external shield requirements. Author

N72-17606*# North American Rockwell Corp., Downey, Calif. Space Div.
EFFECTS OF RADIATION ENVIRONMENT ON REUSABLE NUCLEAR SHUTTLE SYSTEM c30
A. G. Lane *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 48-56 refs (See N72-17601 08-22)
(SD-71-299) Avail: NTIS HC $10.00/MF $0.95 CSCL 22C

Parametric tradeoff analyses of a wide spectrum of alternate tank configurations to minimize both primary and secondary, direct and scattered radiation sources emanating from the NERVA are reported. The analytical approach utilizing point kernel techniques is described and detailed data are presented on the magnitude of neutron/gamma doses for different locations. Single-tank configurations utilizing smaller cone angles and end cap radii were found to minimize integral radiation levels, hence, stage shielding-weight penalties for shuttle missions. Hybrid configurations employing an upper tank with a reduced cone angle and end cap radius result in low integral payload doses primarily due to the increased separation distance caused by the elongation of the larger capacity upper tank. A preliminary radiation damage assessment is discussed of possible reusable nuclear shuttle materials, components, and subsystems, and the possible effects of the radiation environment on various phases of RNS mission operations. Author

N72-17607*# Aerojet Nuclear Co., Idaho Falls, Idaho.
RADIATION ANALYSIS OF VARIOUS VEHICLE AND PAYLOAD CONFIGURATIONS FOR THE REUSABLE NUCLEAR SHUTTLE c31
W. E. Preeg *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 58-64 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22B

Radiation analyses were performed and shielding weight requirements were estimated for various candidate vehicle and payload configurations for use with the reusable nuclear shuttle. The analyses included both point kernel and Monte Carlo approaches. The effects on reduced shield weight were determined for propellant ranks with pointed conical tank bottoms and for one case of a cluster of small tanks. This later case, however, had an arrangement which had no center tank in the upper tier of tanks. This effect negated most of the gain of going to the smaller tanks. A range of shield weights is presented for various light and heavy manned payload configurations when used in conjunction with a single liquid hydrogen propellant tank, 33 ft in diameter with a 15 deg conical tank bottom. Author

N72-17608*# Oak Ridge National Lab., Tenn.
THE ORNL-SNAP SHIELDING PROGRAM
F. R. Mynatt, C. E. Clifford, F. J. Muckenthaler, and M. L. Gritzner *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 66-72 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18N

The effort in the ORNL-SNAP shielding program is directed toward the development and verification of computer codes using numerical solutions to the transport equation for the design of optimized radiation shields for SNAP power systems. A brief discussion is given for the major areas of the SNAP shielding program, which are cross-section development, transport code development, and integral experiments. Detailed results are presented for the integral experiments utilizing the TSF-SNAP reactor. Calculated results are compared with experiments for neutron and gamma-ray spectra from the bare reactor and as transmitted through slab shields. Author

N72-17609*# Oak Ridge National Lab., Tenn.
THE DESIGN OF ASYMMETRIC 4 PI SHIELDS FOR SPACE REACTORS
W. W. Engle, Jr., R. L. Childs, and F. R. Mynatt *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 73-77 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18I

A one dimensional shield optimization program based on the method of discrete ordinates has been developed and is used to determine material thicknesses used in asymmetric 4 pion shields for space power reactors. The two dimensional discrete ordinates program DOT is used to check the design, and the information generated in the DOT calculation is used as a guide in shaping the shield which may be considered a first step in two dimensional shield optimization. Author

N72-17610*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PRELIMINARY SHIELD DESIGN FOR A SNAP-8 POWER SYSTEM
I. M. Karp, L. Soffer, and M. R. Clark *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 78-83 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18N

A preliminary shield design for a nuclear power system utilizing a SNAP-8 reactor for space base application is presented. A representative space base configuration was selected to set the geometry constraints imposed on the design. The base utilizes two independent power packages each with a reactor operating at 600 kwt and each producing about 50 kwe. The crew compartment is located about 200 feet from each reactor and is large enough in extent to intercept a total shadow angle of 60 deg measured about the center line of each reactor. Author

N72-17611*# Teledyne Brown Engineering, Huntsville, Ala.
SNAP-8 POST SHUTDOWN GAMMA RADIATION APPROXIMATIONS
N. R. Byrn, H. T. Smith, and H. S. Manning (NASA, Marshall Space Flight Center) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 84-91 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18N

Detector responses were calculated for normalized sources in the Perkins and King energy group structure for a SNAP 8 power system on a NASA space station. Gamma decay rates were then calculated by using an expanded, updated list of isotopic decay data, and from these, actual detector responses were found for the SNAP 8 system. The results indicate that energy-dependent calculations must be made to determine decay gamma dose rates for actual reactor configurations. A simplified method for making these calculations has been devised. Author

N72-17612*# North American Rockwell Corp., Canoga Park, Calif. Atomics International Div.
SPACE REACTOR SHIELDING FABRICATION
Frank H. Welch *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 92-97 (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18I

The fabrication of space reactor neutron shielding by a melting and casting process utilizing lithium hydride is described. The first neutron shield fabricated is a large pancake shape 86 inches in diameter, containing about 1700 pounds of lithium hydride. This shield, fabricated by the unique melting and casting process, is the largest lithium hydride shield ever built. Author

N72-17613*# California Univ., Livermore. Lawrence Radiation Lab.
NUCLEAR REACTOR DESCRIPTIONS FOR SPACE POWER SYSTEMS ANALYSIS
E. W. McCauley and N. J. Brown *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 98-102 refs Sponsored by AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18L

For the small, high performance reactors required for space electric applications, adequate neutronic analysis is of crucial importance, but in terms of computational time consumed, nuclear calculations probably yield the least amount of detail for mission analysis study. It has been found possible, after generation of only a few designs of a reactor family in elaborate thermomechanical and nuclear detail to use simple curve fitting techniques to assure desired neutronic performance while still performing the thermomechanical analysis in explicit detail. The resulting speed-up in computation time permits a broad detailed examination of constraints by the mission analyst. Author

N72-17614*# Boeing Co., Seattle, Wash.
GALACTIC COSMIC RAY HEAVY PRIMARY SECONDARY DOSES c29
M. C. Wilkinson and S. B. Curtis (Calif. Univ., Berkeley. Lawrence Radiation Lab.) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 104-107 refs (See N72-17601 08-22)
(Contract NASw-1963)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

Results of a calculation which estimates the heavy primary secondary doses from cosmic ray interaction data are reported. The incident galactic cosmic ray heavy primary spectrum is represented as the sum of helium, nitrogen, magnesium, and iron components. The incident iron nuclei are allowed to fragment into lesser Z secondaries, which are assumed to travel in the

same direction and start with the same energy per nucleon as the interacting primary. The total emergent particle energy spectra and dose are then presented for the galactic heavy primary spectrum incident on aluminum and tissue slabs. The importance of the fragmentation parameters assumed is also evaluated. The total dose from the heavy primaries and their secondaries is found to be reduced by only a factor of two in 20 g/sq cm of shielding. Author

N72-17615*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
METHODS OF SPACE RADIATION DOSE ANALYSIS WITH APPLICATIONS TO MANNED SPACE SYSTEMS **c29**
R. W. Langley and M. P. Billings *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 108-116 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

The full potential of state-of-the-art space radiation dose analysis for manned missions has not been exploited. Point doses have been overemphasized, and the critical dose to the bone marrow has been only crudely approximated, despite the existence of detailed man models and computer codes for dose integration in complex geometries. The method presented makes it practical to account for the geometrical detail of the astronaut as well as the vehicle. Discussed are the major assumptions involved and the concept of applying the results of detailed proton dose analysis to the real-time interpretation of on-board dosimetric measurements. Author

N72-17616*# Oak Ridge National Lab., Tenn.
MONTE CARLO CALCULATIONS OF HIGH ENERGY NUCLEON MESON CASCADES AND APPLICATIONS TO GALACTIC COSMIC RAY TRANSPORT **c24**
T. W. Armstrong, R. G. Alsmiller, Jr., and K. C. Chandler *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 117-122 refs (See N72-17601 08-22)
(NASA Order H-38280A)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

Results obtained using a recently developed calculational method for determining the nucleon-meson cascade induced in thick materials by high-energy nucleons and charged pions are presented. The calculational method uses the intranuclear-cascade-evaporation model at higher energies. The following configurations are considered: (1) 19.2-GeV/c protons incident on iron; (2) 30.3-GeV/c protons incident on iron; (3) solar and galactic protons incident on the moon, and (4) galactic protons incident on tissue. For the first three configurations, experimental results are available and comparisons between the experimental and calculated results are given. Author

N72-17617*# Oak Ridge National Lab., Tenn.
CALCULATION OF THE ABSORBED DOSE AND DOSE EQUIVALENT INDUCED BY MEDIUM ENERGY NEUTRONS AND PROTONS AND COMPARISON WITH EXPERIMENT **c04**
T. W. Armstrong and B. L. Bishop *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 123-127 refs (See N72-17601 08-22)
(NASA Order H-38280A)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

Monte Carlo calculations have been carried out to determine the absorbed dose and dose equivalent for 592-MeV protons incident on a cylindrical phantom and for neutrons from 580-MeV proton-Be collisions incident on a semi-infinite phantom. For both configurations, the calculated depth dependence of the absorbed dose is in good agreement with experimental data. Author

N72-17618*# Oak Ridge National Lab., Tenn.
PRIMARY AND SECONDARY PARTICLE CONTRIBUTIONS TO THE DEPTH DOSE DISTRIBUTION IN A PHANTOM SHIELDED FROM SOLAR FLARE AND VAN ALLEN PROTONS **c04**
R. T. Santoro, H. C. Claiborne, and R. G. Alsmiller, Jr. *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 128-136 refs (See N72-17601 08-22)
(NASA Order H-38280A)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

Calculations have been made using the nucleon-meson transport code NMTC to estimate the absorbed dose and dose equivalent distributions in astronauts inside space vehicles bombarded by solar flare and Van Allen protons. A spherical shell shield of specific radius and thickness with a 30-cm-diam. tissue ball at the geometric center was used to simulate the spacecraft-astronaut configuration. The absorbed dose and the dose equivalent from primary protons, secondary protons, heavy nuclei, charged pions, muons, photons, and positrons and electrons are given as a function of depth in the tissue phantom. Results are given for solar flare protons with a characteristic rigidity of 100 MV and for Van Allen protons in a 240-nautical-mile circular orbit at 30 degree inclination angle incident on both 20-g/sq cm-thick aluminum and polyethylene spherical shell shields. Author

N72-17619*# North Carolina Univ., Chapel Hill.
HEAVY ION PASSIVE DOSIMETRY WITH SILVER HALIDE SINGLE CRYSTALS **c26**
Charles B. Childs and Thomas A. Parnell *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 138-141 refs (See N72-17601 08-22)
(Contract NAS8-26601; Grant NGL-34-003-040; Contract ARPA SD-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20L

A method of detecting radiation damage tracks due to heavy particles in large single crystals of the silver halides is described. The tracks, when made visible with a simple electrical apparatus, appear similar to tracks in emulsions. The properties of the crystals, the technique of printing out the tracks, and evidence concerning the threshold energy for registering particles indicates that this method may find application in heavy ion dosimetry. The method has been found to be sensitive to stopping He nuclei and relativistic M group cosmic rays. Some impurities strongly influence the printout of the tracks, and the effects of these impurities are discussed. Author

N72-17620*# Advanced Technology Center, Inc., Dallas, Tex.
A REAL TIME SPECTRUM TO DOSE CONVERSION SYSTEM **c14**
B. J. Farmer, J. H. Johnson, and R. G. Bagwell *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 142-148 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

A system has been developed which permits the determination of dose in real time or near real time directly from the pulse-height output of a radiation spectrometer. The technique involves the use of the resolution matrix of a spectrometer, the radiation energy-to-dose conversion function, and the geometrical factors, although the order of matrix operations is reversed. The new technique yields a result which is mathematically identical to the standard method while requiring no matrix manipulations or resolution matrix storage in the remote computer. It utilizes only a single function for each type dose required and each geometric factor involved. Author

N72-17621*# San Francisco Univ., Calif.
HIGH Z PARTICLE APOLLO ASTRONAUT DOSIMETRY WITH PLASTICS **c04**
E. V. Benton and R. P. Henke *In* NASA, Washington Proc. of The Natl. Symp. on Nat. and Manmade Radiation in Space Jan.

1972 p 149-156 refs Sponsored by NASA (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

On Apollo missions, the individual astronauts' high Z particle exposure is measured by means of Lexan polycarbonate plastic. These layers form one component of the passive dosimetry packets worn in the constant wear garment. They serve as threshold type, high Z, charged particle track detectors, recording only the very highly ionizing particles. The detectors yield information on the particles' charge, energy, and direction of travel. This data, in turn, is used to obtain the track fluence, the stopping particle density as an integral Z distribution, and the particles' integral LET spectrum. Some of the data gathered on Apollo missions 8-13 is presented. Author

N72-17622*# California Univ., La Jolla. Dept. of Radiology.
FLUCTUATIONS IN ENERGY LOSS AND THEIR IMPLICATIONS FOR DOSIMETRY AND RADIOBIOLOGY **c04**
Norman A. Baily and John E. Steigerwalt *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 157-161 refs (See N72-17601 08-22)
(Grant NGL-05-009-103)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

Serious consideration of the physics of energy deposition indicates that a fundamental change in the interpretation of absorbed dose is required at least for considerations of effects in biological systems. In addition, theoretical approaches to radiobiology and microdosimetry seem to require statistical considerations incorporating frequency distributions of the magnitude of the event sizes within the volume of interest. Author

N72-17623*# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
THE MEASUREMENT OF RADIATION EXPOSURE OF ASTRONAUTS BY RADIOCHEMICAL TECHNIQUES **c04**
R. L. Brodzinski *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 162-167 refs (See N72-17601 08-22)
(Contract AT(45-1)-1830)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

The principal gamma-ray emitting radioisotopes, produced in the body of astronauts by cosmic-ray bombardment, which have half-lives long enough to be useful for radiation dose evaluation, are Be-7, Na-22, and Na-24. The sodium isotopes were measured in the preflight and postflight urine and feces, and those feces specimens collected during the manned Apollo missions, by analysis of the urine salts and the raw feces in large crystal multidimensional gamma-ray spectrometers. The Be-7 was chemically separated, and its concentration measured in an all NaI (TL), anticoincidence shielded, scintillation well crystal. The astronaut radiation dose in millirads, as determined for the Apollo 7, 8, 9, 10, 11, 12, and 13 missions, was 330, 160, smaller than 315, 870 plus or minus 550, 31, 110, and smaller than 250, respectively. Author

N72-17624*# Air Force Weapons Lab., Kirtland AFB, N.Mex.
THE GEOMAGNETICALLY TRAPPED RADIATION ENVIRONMENT: A RADIOLOGICAL POINT OF VIEW **c29**
F. Eugene Holly *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 170-177 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

The regions of naturally occurring, geomagnetically trapped radiation are briefly reviewed in terms of physical parameters such as; particle types, fluxes, spectrums, and spatial distributions. The major emphasis is placed upon a description of this environment in terms of the radiobiologically relevant parameters of absorbed dose and dose-rate and a discussion of the radiological implications in terms of the possible impact on space vehicle design and mission planning. Author

N72-17625*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
ARTIFICIAL PERTURBATIONS OF THE RADIATION BELTS **c29**
John B. Cladis *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 178-192 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

A review is given of the properties of the radiation belts which have been produced by high-altitude nuclear detonations. The low-yield, Argus devices, 1, 2, and 3, and the Soviet test of 1 November 1962 injected intense electron fluxes in narrow L-shell intervals, with peaks at L = 1.72, 2.11, 2.17, and 1.77, respectively. The energy spectra of the electrons were indistinguishable from the equilibrium fission beta spectrum, and the fluxes initially decayed at rates approximately proportional to (time) sup -1.1. The high-yield devices, Starfish and the Soviet tests of 22 October and 28 October 1962, injected electrons over wide ranges. At L values near the lower boundary, the electron spectra appeared to be softer at the higher L values. Author

N72-17626*# Bell Telephone Labs., Inc., Murray Hill, N.J.
SOLAR FLARE PARTICLE RADIATION **c29**
L. J. Lanzerotti *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 193-208 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

The characteristics of the solar particles accelerated by solar flares and subsequently observed near the orbit of the earth are studied. Considered are solar particle intensity-time profiles, the composition and spectra of solar flare events, and the propagation of solar particles in interplanetary space. The effects of solar particles at the earth, riometer observations of polar cap cosmic noise absorption events, and the production of solar cell damage at synchronous altitudes by solar protons are also discussed. Author

N72-17627*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
THE CHEMICAL COMPOSITION AND ENERGY CONTENT OF THE ENERGETIC COSMIC RADIATION **c29**
C. J. Waddington *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 209-214 refs (See N72-17601 08-22)
(Contract N00014-67-A-0113-0021)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

A brief survey is made of our present knowledge of the composition and energy spectra of the primary cosmic radiation. The total energy carried by all forms of cosmic radiation that have appreciable penetrability into matter has been evaluated. Author

N72-17628*# Naval Aerospace Medical Inst., Pensacola, Fla.
APOLLO MISSION EXPERIENCE **c29**
Herman J. Schaefer *In* NASA Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 215-219 Sponsored by NASA (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

Dosimetric implications for manned space flight are evaluated by analyzing the radiation field behind the heavy shielding of a manned space vehicle on a near-earth orbital mission and how it compares with actual exposure levels recorded on Apollo missions. Emphasis shifts from flux densities and energy spectra to incident radiation and absorbed doses and dose equivalents as they are recorded within the ship at locations close to crew members. Author

N72-17629*# Wisconsin Univ., Madison. Radiotherapy Center.
A REVIEW: SOME BIOLOGICAL EFFECTS OF HIGH LET RADIATIONS **c04**
Albert Wiley, Jr. *In* NASA, Washington Proc. of the Natl.

Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 223-228 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

There are qualitative and quantitative differences in the biological damage observed after exposure to high LET radiation as compared to that caused by low LET radiations. This review is concerned with these differences, which are ultimately reflected at the biochemical, cellular and even whole animal levels. In general, high LET radiations seem to produce biochemical damage which is more severe and possibly less repairable. Experimental data for those effects are presented in terms of biochemical RBE's with consideration of both early and late manifestations. An LET independent process by which significant biochemical damage may result from protons, neutrons and negative pion mesons is discussed. Author

N72-17630*# Washington Univ., Seattle.
EFFECTS OF X-RAY IRRADIATION ON HUMAN SPERMATOGENESIS **c04**
T. W. Thorslund and C. A. Paulsen *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 229-232 (See N72-17601 08-22)
(Contracts AT(45-1)-1781; AT(45-1)-2225; Grants AM-05161; AM-05436)
Avail: NTIS HC $10.00 MF $0.95 CSCL 06R

Direct cell kill and inhibition of mitosis have been suggested as mechanisms to explain the occurrence of absolute sterility following the irradiation of the testes. In order to obtain information on the existence and dose dependency of the mechanisms for man, a controlled study was initiated. Sixty-four men received a single midorgan dose to both of their testes ranging from 7.5 to 400r (f = .95). It was deduced from resulting pre-sterile period and sterile period data that both cell kill and mitosis halting mechanisms were operating. The maximum observed sterile period was 501 days with eventual recovery observed in each individual where the follow-up was complete. Thus man appears to be highly radiosensitive in regard to temporary sterility but quite radioresistant in regard to permanent sterility. Author

N72-17631*# Oak Ridge National Lab., Tenn.
MULTIFACTORIAL ANALYSIS OF HUMAN BLOOD CELL RESPONSES TO CLINICAL TOTAL BODY IRRADIATION **c04**
John M. Yuhas, T. R. Stokes, and C. C. Lushbaugh *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 233-237 refs Sponsored by AEC and NASA Prepared in cooperation with Oak Ridge Assoc. Univ. (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

Multiple regression analysis techniques are used to study the effects of therapeutic radiation exposure, number of fractions, and time on such quantal responses as tumor control and skin injury. The potential of these methods for the analysis of human blood cell responses is demonstrated and estimates are given of the effects of total amount of exposure and time of protraction in determining the minimum white blood cell concentration observed after exposure of patients from four disease groups. Author

N72-17632*# Oak Ridge Associated Universities, Tenn.
PULMONARY-IMPEDANCE POWER SPECTRAL ANALYSIS: A FACILE MEANS OF DETECTING RADIATION-INDUCED GASTROINTESTINAL DISTRESS AND PERFORMANCE DECREMENT IN MAN **c04**
Robert C. Rick, C. C. Lushbaugh, Earl McDow, and Edward Frome (Emory Univ., Atlanta) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 238-248 refs Sponsored by NASA and AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

Changes in respiratory variance revealed by power spectral analysis of the pulmonary impedance pneumogram can be used to detect and measure stresses directly or indirectly affecting human respiratory function. When gastrointestinal distress occurred during a series of 5 total-body exposures of 30 R at a rate of 1.5 R/min, it was accompanied by typical shifts in pulmonary impedance power spectra. These changes did not occur after protracted exposure of 250 R (30 R daily) at 1.5 R/hr that failed to cause radiation sickness. This system for quantitating respiratory effort can also be used to detect alterations in one's ability to perform under controlled exercise conditions. Author

N72-17633*# North American Rockwell Corp., Downey, Calif. Space Div.
THE INFLUENCE OF RADIATION SHIELDING ON REUSABLE NUCLEAR SHUTTLE DESIGN **c31**
T. M. Littman and D. Garcia *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 251-256 refs (See N72-17601 08-22)
(Contract NAS8-24975)
(SD-71-441) Avail: NTIS HC $10.00/MF $0.95 CSCL 22B

Alternate reusable nuclear shuttle configurations were synthesized and evaluated. Particular attention was given to design factors which reduced tank exposure to direct and scattered radiation, increased payload-engine separation, and improved self-shielding by the LH2 propellant. The most attractive RNS concept in terms of cost effectiveness consists of a single conical aft bulkhead tank with a high fineness ratio. Launch is accomplished by the INT-21 with the tank positioned in the inverted attitude. The NERVA engine is delivered to orbit separately where final stage assembly and checkout are accomplished. This approach is consistent with NERVA definition criteria and required operating procedures to support an economically viable nuclear shuttle transportation program in the post-1980 period. Author

N72-17634*# Aerojet Nuclear Systems Co., Sacramento, Calif.
RADIATION ENVIRONMENT FOR RENDEZVOUS AND DOCKING WITH NUCLEAR ROCKETS **c30**
D. R. Rogers, E. A. Warman, and B. A. Lindsey *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 257-263 Sponsored by NASA and AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22A

Radiation environment data for the NERVA engine are provided which may be utilized in estimating radiation exposures associated with various spa ce maneuvers. Spatial distributions of neutron and gamma tissue kerma rates produced during full thrust operation of the engine are presented. Final rendezvous with an orbiting space station would be achieved subsequent to full thrust operation during a period of 10 or more hours duration in which impulse is delivered by the propellant used for removal of decay heat. Consequently, post operation radiation levels are of prime importance in estimating space station exposures. Maps of gamma kerma rates around the engine are provided for decay times of 4 and 24 hours after a representative firing. Typical decay curves illustrating the dependence of post operation kerma rates on decay time and operating history are included. Examples of the kerma distributions around the engine which result from integration over specific exposure periods are shown. Author

N72-17635*# Lo ckheed Missiles and Spa ce Co., Sunnyvale, Calif.
RADIATION EXPOSURE TO THE ORBITING LUNAR STATION AND LUNAR SURFACE RELATED TO REUSABLE NUCLEAR SHUTTLE OPERATIONS **c30**
Paul I. Hutchinson *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 264-269 (See N72-17601 08-22)
(Contract NAS8-24715; NAS9-10969)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22A

The radiation environment created by the Reusable Nuclear Vehicle (RNS) in performing its normal mission functions while in

the lunar vicinity and the impact of that environment on the Orbiting Lunar Station (OLS) and/or the lunar surface are examined. Lunar surface exposures from the operating reactor were evaluated for both the arrival and departure burns and while there is little probability that manned bases would lie along the paths in which measurable exposures would be recorded, the analyses do indicate the need to consider this possibility in planning such operations. Conclusions supported by the analyses and recommended operational constraints for the RNS are presented. Author

N72-17636*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INTEGRAL DOSE DURING CONSTANT VELOCITY MOTION NEAR A SPACE POWER REACTOR
H. S. Manning *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 270-276 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18L

The dose rate in a rotationally-symmetric radiation field near a space power reactor is assumed to be inversely proportional to separation distance squared and directly proportional either to a constant or a constant times the sine-cubed of a polar angle. Constant velocity motion is examined in both cases in both two and three dimensional geometries. The two dimensional geometry occurs when the line of motion and the field axis of symmetry are co-planar. The dose integral in the sine-cubed region may be integrated directly, but a more useful form is obtained after a change of variable. A coordinate system rotation greatly simplifies the results. The three dimensional problem is integrated after a change of variable. Finally, tables of normalized functions are presented and discussed. Author

N72-17637*# Aerojet Nu clear Systems Co., Sacramento, Calif.
TELEOPERATORS FOR REMOTE OPERATIONS IN SPACE **c15**
L. E. Little and F. L. DiLorenzo *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 277-279 Sponsored by AEC and NASA (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 13I

The primary objective of the remote nuclear teleoperator study program was to define in detail a program plan which would provide a qualified operational space teleoperator system by about 1980. The concept and philosophy presented provides a product considered to be an advanced teleoperator when compared to today's state-of-the-art. The teleoperator concept is formulated to meet NERVA requirements. Author

N72-17638*# General Electric Co., Philadelphia, Pa.
TELEOPERATOR SYSTEMS FOR MANNED SPACE MISSIONS **c15**
Alfred Interian *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 280-290 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 13I

The development of remote mechanical systems to augment man's capabilities in our manned space effort is considered. A teleoperator system extends man's innate intelligence and sensory capabilities to distant hostile and hazardous environments through a manipulator-equipped spacecraft and an RF link. Examined are space teleoperator system applications in the space station/space shuttle program, which is where the most immediate need exists and the potential return is greatest. Author

N72-17639*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Research and Advanced Concepts Section.
NUCLEAR RADIATION PROBLEMS, UNMANNED THERMIONIC REACTOR ION PROPULSION SPACECRAFT
J. F. Mondt, C. D. Sawyer, and A. Nakashima *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 292-298 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail. NTIS $10.00/MF $0.95 CSCL 18E

A nuclear thermionic reactor as the electric power source for an electric propulsion spacecraft introduces a nuclear radiation environment that affects the spacecraft configuration, the use and location of electrical insulators and the science experiments. The spacecraft is conceptually configured to minimize the nuclear shield weight by: (1) a large length to diameter spacecraft; (2) eliminating piping penetrations through the shield; and (3) using the mercury propellant as gamma shield. Since the alumina material is damaged by the high nuclear radiation environment in the reactor it is desirable to locate the alumina insulator outside the reflector or develop a more radiation resistant insulator. Author

N72-17640*# Gulf General Atomic, San Diego, Calif.
THERMIONIC REACTOR POWER SYSTEM: EFFECTS OF RADIATION ON INTEGRATION WITH MANNED SPACE STATION
A. J. Gietzen, C. A. Heath, and L. W. Perry *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 299-306 refs (See N72-17601 08-22)
(Contract AT(04-3)-167)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18E

The application of a thermionic reactor power system to the modular space station is described. The nominal net power is 40 kWe, with the power system designed to be applicable over the power range from 25 to 60 kWe. The power system is designed to be laun ched by the space shuttle. Radiation protection is provided by LiH neutron shielding and W gamma shielding in a shaped 4 pion configuration, i.e., the reactor is shielded on all sides but not to equal extent. Isodose contours are presented for the region around the modular space station. Levels and spe ctral distribution of radiation are given for later evaluation of effects on space station experiments. Parametric data on the effects of separation distance on power system mass are presented. Author

N72-17641*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE RISK OF SOLAR PROTON EVENTS TO SPACE MISSIONS **c29**
Martin O. Burrell *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 310-323 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

The total dose in rads-tissue from solar protons was tabulated for weekly time intervals, and the number of weeks which gave a dose above 25 rads behind 10 g/sq cm of aluminum for the active 6 years of the 19th cycle were called dangerous or large event weeks. The number of such event weeks was found to be only 3 weeks for the past 20 years. Even though the chance for smaller events is examined, it was found that for any reasonable, high confidence level (95%), the smaller events could be ignored. Consequently, the total particle flux for the 19th cycle was divided by a factor of 3 and determined a single large event week. Using this spectrum, the tissue dose in rads is calculated at the center of an aluminum spherical shell. Author

N72-17642*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROBABLE SOLAR FLARE DOSES ENCOUNTERED ON AN INTERPLANETARY MISSION AS CALCULATED BY THE MCFLARE CODE **c29**
Gerald P. Lahti and Irving M. Karp *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 324-328 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

The computer program, MCFLARE, uses Monte Carlo methods to simulate solar flare occurrences during an

interplanetary space voyage. The total biological dose inside a shielded crew compartment due to the flares encountered during the voyage is determined. The computer program evaluates the doses obtained on a large number of trips having identical trajectories. From these results, a dose D sub p having a probability p of not being exceeded during the voyage can be determined as a function of p for any shield material configuration. To illustrate the use of the code, a trip to Mars and return is calculated, and estimated doses behind several thicknesses of aluminum shield and water shield are presented.
Author

N72-17643*# Lockheed Electronics Co., Houston, Tex.
THE SIGNIFICANT SOLAR PROTON EVENTS IN 20TH SOLAR CYCLE FOR THE PERIOD OCTOBER 1964 TO MARCH 1970 **c29**
W. Atwell *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 329-335 refs (See N72-17601 08-22)
(Contract NAS9-10950)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

Solar proton data are presented from observations by the Explorer 21, 28, 34 and 41 satellites. The NASA Solar Particle Alert Network (SPAN) solar optical and radio frequency data for the period May 1967 to March 1970 are associated with the proton events observed by the Explorer 34 and 41 satellites; however, missing data are supplemented with data recorded at other international observatories. From a radiation hazard standpoint, NASA is concerned with solar proton events of the order of 10 to the 8th power proton/sq cm. Radiation dose data are presented for some of the large proton events that have occurred thus far in the 20th solar cycle and are compared with some of the large proton events of the 19th solar cycle. Finally, the results of a simple parametric correlation study are presented for both the 19th and 20th solar cy cles. Author

N72-17644*# North American Rockwell Corp., Downey, Calif. Space Div.
TIME BEHAVIOR OF SOLAR FLARE PARTICLES TO 5 AU **c29**
J. W. Haffner *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 336-344 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

A simple model of solar flare radiation event particle transport is developed to permit the calculation of fluxes and related quantities as a function of distance from the sun (R). This model assumes the particles spiral around the solar magnetic field lines with a constant pitch angle. The particle angular distributions and onset plus arrival times as functions of energy at 1 AU agree with observations if the pitch angle distribution peaks near 90 deg. As a consequence the time dependence factor is essentially proportional to R/1.7, (R in AU), and the event flux is proportional to R/2. Author

N72-17645*# McDonnell-Douglas Co., Huntington Beach, Calif.
SOLAR COSMIC RAY HAZARD TO INTERPLANETARY AND EARTH-ORBITAL SPACE TRAVEL **c29**
W. R. Yucker *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 345-355 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

A statistical treatment of the radiation hazards to astronauts due to solar cosmic ray protons is reported to determine shielding requirements for solar proton events. More recent data are incorporated into the present analysis in order to improve the accuracy of the predicted mission fluence and dose. The effects of the finite data sample are discussed. Mission fluence and dose versus shield thickness data are presented for mission lengths up to 3 years during periods of maximum and minimum solar activity; these correspond to various levels of confidence that the predicted hazard will not be exceeded. Author

N72-17646*# Air Force Weapons Lab., Kirtland AFB, N.Mex.
SHORT TERM PREDICTION OF E GREATER THAN OR EQUAL TO 10 MeV PROTON FLUXES FROM SOLAR FLARES **c29**
George A. Kuck *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 356-361 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

Both the anisotropic and isotropic diffusion theories can be used to extrapolate proton fluxes for E greater than or equal to 10 meV for over 50% of the particle events. The isotropic diffusion theory uses a diffusion coefficient: D = Mr sup beta. It was found that M and beta tended to be functions of flare position on the solar disk. A measurement of the interplanetary flux in near earth space gives a good indication of the polar cap fluxes. It was found that the 30 MHz absorption over the poles during a PCA is proportional to the square root of the integral proton flux E greater than or equal to 11 meV in interplanetary space, J = KA squared, with K = 8 plus or minus 2 and J in protons/sq cm-sec-ster. Author

N72-17647*# Air Force Weapons Lab., Kirtland AFB, N.Mex.
A MODULAR APPROACH FOR ASSESSING THE EFFECT OF RADIATION ENVIRONMENTS ON MAN IN OPERATIONAL SYSTEMS. THE RADIOBIOLOGICAL VULNERABILITY OF MAN DURING TASK PERFORMANCE **c04**
Dean E. Ewing *In* NASA, Washington Proc. of Natl. Symp. on Nat. and Manmade Radiation in Spa ce Jan. 1972 p 364-367 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

A modular approach for assessing the affects of radiation environments on man in operational systems has been developed. The feasibility of the model has been proved and the practicality has been assessed. It has been applied to one operational system to date and information obtained has been submitted to systems analysts and mission planners for the assessment of man's vulnerability and impact on systems survivability. In addition, the model has been developed so that the radiobiological data can be input to a sophisticated man-machine interface model to properly relate the radiobiological stress with other mission stresses including the effects of a degraded system. Author

N72-17648*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
OPTIMAL SHIELD MASS DISTRIBUTION FOR SPACE RADIATION PROTECTION
M. P. Billings *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 368-374 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18F

Computational methods have been developed and successfully used for determining the optimum distribution of space radiation shielding on geometrically complex space vehicles. These methods have been incorporated in computer program SWORD for dose evaluation in complex geometry, and iteratively calculating the optimum distribution for (minimum) shield mass satisfying multiple acute and protected dose constraints associated with each of several body organs. Author

N72-17649*# Gulf Radiation Technology, San Diego, Calif.
DEVELOPMENT AND VERIFICATION OF DESIGN METHODS FOR DUCTS IN A SPACE NUCLEAR SHIELD
R. J. Cerbone, W. E. Selph, and P. A. Read *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 375-382 refs (See N72-17601 08-22)
(Contract AT(04-3)-167)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18I

A practical method for computing the effectiveness of a space nuclear shield perforated by small tubing and cavities is reported. Performed calculations use solutions for a two

dimensional transport code and evaluate perturbations of that solution using last flight estimates and other kernel integration techniques. In general, perturbations are viewed as a change in source strength of scattered radiation and a change in attenuation properties of the region. Author

N72-17650*# Iowa State Univ. of Science and Technology, Ames. Dept. of Nuclear Engineering.
APPLICATION OF THE MATRIX EXPONENTIAL KERNEL **c24**
Alfred F. Rohach *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 383-386 refs Sponsored by AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18I

A point matrix kernel for radiation transport, developed by the transmission matrix method, has been used to develop buildup factors and energy spectra through slab layers of different materials for a point isotropic source. Combinations of lead-water slabs were chosen for examples because of the extreme differences in shielding properties of these two materials. Author

N72-17651*# Hughes Aircraft Co., Culver City, Calif.
A SIMPLE CODE FOR USE IN SHIELDING AND RADIATION DOSAGE ANALYSES
C. C. Wan *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 387-391 ref (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18F

A simple code for use in analyses of gamma radiation effects in laminated materials is described. Simple and good geometry is assumed so that all multiple collision and scattering events are excluded from consideration. The code is capable of handling laminates up to six layers. However, for laminates of more than six layers, the same code may be used to incorporate two additional layers at a time, making use of punch-tape outputs from previous computation on all preceding layers. Spectrum of attentuated radiation are obtained as both printed output and punch tape output as desired. Author

N72-17652*# Massachusetts Univ., Amherst.
CARPET PLOT DATA FORMAT **c08**
Joseph M. Byrne *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 392-396 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 09B

Analysis and interpretation of data is the crucial phase of the decision making process. The interplay between variables must be considered as to their relative significance upon the final result, and sometimes time-sensitive decisions must be made when actual events deviate from predicted information, such as Apollo 13. As the number of variables increases past say four, the traditional method of cross-plotting tends to break down, and digital/analog results cannot present a sharply defined method of analysis. A graphical system, the carpet plot, is presented in which an unlimited number of complicated relationships of variables can be evaluated. Author

N72-17653*# Oak Ridge Associated Universities, Tenn. Medical Div.
PREDICTED LEVELS OF HUMAN RADIATION TOLERANCE EXTRAPOLATED FROM CLINICAL STUDIES OF RADIATION EFFECTS **c04**
C. C. Lushbaugh *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 398-415 refs Sponsored in part by AEC and NASA (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

Results of clinical studies of radiation effects on man are used to evaluate space radiation hazards encountered during manned space travel. Considered are effects of photons as well as of mixed fission neutrons and gamma irradiations in establishing body radiosensitivity and tolerance levels. Upper and lower dose-response-time relations for acute radiation syndromes in patients indicate that man is more than sufficiently radioresistant to make the risks of an early radiation effect during one short space mission intangibly small in relation to the other nonradiation risks involved. G.G.

N72-17654*# California Univ., Berkeley. Lawrence Radiation Lab.
HUMAN VISUAL RESPONSE TO NUCLEAR PARTICLE EXPOSURES **c24**
C. A. Tobias, T. F. Budinger, and J. T. Lyman *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 416-422 refs Sponsored jointly by NASA and AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

Experiments with accelerated helium ions were performed in an effort to localize the site of initial radiation interactions in the eye that lead to light flash observations by astronauts during spaceflight. The character and efficiency of helium ion induction of visual sensations depended on the state of dark adaptation of the retina; also, the same events were seen with different efficiencies and details when particle flux density changed. It was concluded that fast particles cause interactions in the retina, particularly in the receptor layer, and thus give rise to the sensations of light flashes, streaks, and supernovae. G.G.

N72-17655*# California Univ., Irvine. Coll. of Medicine.
ON THE USE OF QUALITY FACTORS AND FLUENCE TO DOSE RATE CONVERSION IN HUMAN RADIATION EXPOSURES **c04**
C. A. Sondhaus *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 424-434 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

It is shown that various combinations of numbers and factors arrive at estimates of dose and dose effectiveness from values of fluence; but as yet it has not been possible to use biological data with the same degree of precision to estimate the physical data. It would seem that the most reasonable way to use the human data that exist is to apply them as far as possible to the human animal as a whole. Author

N72-17656*# Columbia Univ., New York. Radiological Research Labs.
METHODS AND APPROACHES TO DOSIMETRY **c04**
Harald H. Rossi *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 435-437 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

The development of a dosimetric system capable of determining energy depositions in tissue regions that are smaller than a few 100 nanometers is projected. These objectives are met by evaluation of the data produced by a macro-subsystem and a micro-subsystem. Both systems are in essence multiple ionization chambers that are normally operated in a gated pulse mode. The macro-system yields absorbed radiation dose as a function of location in a phantom of the human trunk when it operates in the dose mode; it registers only those sections as a signal in which the primary particle or any of its secondaries have passed, in the pulse mode. The function of the micro-system is to provide detailed information of the track structure by determining lateral energy spread due to delta ray formation or other secondary particle production. G.G.

N72-17657*# Los Alamos Scientific Lab., N.Mex.
THE EXTERNAL GAMMA RADIATION ENVIRONMENT FROM THE KIWI PHOEBUS, AND PEWEE REACTORS
Richard E. Malenfant *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 440-448 refs Sponsored by AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18H

During the past few years, ground tests of high-powered propulsion-prototype reactors have provided several opportunities to observe the external radiation environment. Reactor tests have been conducted in free air and inside of open well shields. Measurements were taken over distances ranging from contact with the pressure vessel out to greater than 5000' both during operation and after shutdown. Some measurements characteristic of each of the systems are presented and compared with results of calculations. Author

N72-17658*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.

APPLICATION OF TRANSPORT TECHNIQUES TO THE ANALYSIS OF NERVA SHADOW SHIELDS

M. A. Capo and S. L. Anderson *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 449-459 refs Sponsored jointly by NASA and AEC (See N72-17601 08-22)

Avail: NTIS HC $10.00/MF $0.95 CSCL 18F

A radiation shield internal to the NERVA nuclear rocket reactor required to limit the neutron and photon radiation levels at critical components located external to the reactor was evaluated. Two significantly different shield mockups were analyzed: BATH, a composite mixture of boron carbide, aluminum and titanium hydride, and a borated steel-liquid hydrogen system. Based on the comparisons between experimental and calculated neutron and photon radiation levels, the following conclusions were noted: (1) The ability of two-dimensional discrete ordinates code to predict the radiation levels internal to and at the surface of the shield mockups was clearly demonstrated. (2) Internal to the BATH shield mockups, the one-dimensional technique predicted the axial variation of neutron fluxes and photon dose rates; however, the magnitude of the neutron fluxes was about a factor of 1.8 lower than the two-dimensional analysis and the photon dose rate was a factor of 1.3 lower. Author

N72-17659*# Aerojet Nuclear Systems Co., Sacramento, Calif. Nuclear Science Section.

RADIATION HEATING IN SELECTED NERVA ENGINE COMPONENTS

J. C. Courtney, N. A. Hertelendy, and B. A. Lindsey *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 460-465 refs Sponsored jointly by NASA and AEC (See N72-17601 08-22)

Avail: NTIS HC $10.00/MF $0.95 CSCL 18E

The role of heating from nuclear radiation in design of the NERVA engine is treated. Some components are subjected to very high gamma heating rates in excess of 0.5 Btu/cubic inch/sec in steel in the primary nozzle or 0.25 Btu/cubic inch/sec in aluminum in the pressure vessel. These components must be cooled by a fraction of the liquid hydrogen propellant before it is passed through the core, heated, and expanded out the nozzle as a gas. Other components that are subjected to lower heating rates such as the thrust structure and the disk shield are designed so that they would not require liquid hydrogen cooling. Typical gamma and neutron heating rates, resulting temperatures, and their design consequences are discussed. Calculational techniques used in the nuclear and thermal analyses of the NERVA engine are briefly treated. Author

N72-17660*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.

SELECTION AND USE OF TLDS FOR HIGH PRECISION NERVA SHIELDING MEASUREMENTS

H. C. Woodsum *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 466-470 refs Sponsored jointly by AEC and NASA (See N72-17601 08-22)

Avail: NTIS HC $10.00/MF $0.95 CSCL 18F

An experimental evaluation of thermoluminescent dosimeters was performed in order to select high precision dosimeters for a study whose purpose is to measure gamma streaming through the coolant passages of a simulated flight type internal NERVA reactor shield. Based on this study, the CaF2 chip TLDs are the most reproducible dosimeters with reproducibility generally within a few percent, but none of the TLDs tested met the reproducibility criterion of plus or minus 2%. Author

N72-17661*# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.

RADIATION HARDENING OF COMPONENTS AND SYSTEMS FOR NUCLEAR ROCKET VEHICLE APPLICATIONS

William A. Greenhow and Paul R. Cheever *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 471-475 refs (See N72-17601 08-22) (Contract NAS8-25848)

Avail: NTIS HC $10.00/MF $0.95 CSCL 18E

The results of the analysis of the S-2 and S-4B components, although incomplete, indicate that many Saturn 5 components and subsystems, e.g., pumps, valves, etc., can be radiation hardened to meet NRV requirements by material substitution and minor design modifications. Results of these analyses include (1) recommended radiation tolerance limits for over 100 material applications; (2) design data which describes the components of each system; (3) presentation of radiation hardening examples of systems; and (4) designing radiation effects tests to supply data for selecting materials. Author

N72-17662*# General Dynamics/Fort Worth, Tex.

THERMODYNAMIC AND TRANSPORT PROPERTIES OF FROZEN AND REACTING pH2-oH2 MIXTURES c23

H. G. Carter and R. E. Bullock *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 476-480 refs (See N72-17601 08-22)

Avail: NTIS HC $10.00/MF $0.95 CSCL 20L

Application of experimental state data and spectroscopic term values shows that the thermodynamic and transport properties of reacting pH2-oH2 mixtures are considerably different than those of chemically frozen pH2 at temperatures below 300 R. Calculated H-S data also show that radiation-induced pH2-oH2 equilibration at constant enthalpy produces a temperature drop of at least 28 R, corresponding to an ideal shaft work loss of 15% or more for a turbine operating downstream from the point of conversion. Aside from differences in thermodynamic and transport properties, frozen pH2-oH2 mixtures may differ from pure pH2 on a purely hydrodynamical basis. Author

N72-17663*# Air Force Cambridge Research Labs., Bedford, Mass.

HARDENING ELECTRONIC DEVICES AGAINST VERY HIGH TOTAL DOSE RADIATION ENVIRONMENTS c24

B. Buchanan, W. Shedd, S. Roosild, and R. Dolan *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 481-486 refs (See N72-17601 08-22)

Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

The possibilities and limitations of hardening silicon semiconductor devices to the high neutron and gamma radiation levels and greater than 10 to the eighth power rads required for the NERVA nuclear engine development are discussed. A comparison is made of the high dose neutron and gamma hardening potential of bipolar, metal insulator semiconductors and junction field effect transistors. Experimental data is presented on device degradation for the high neutron and gamma doses. Previous data and comparisons indicate that the JFET is much more immune to the combined neutron displacement and gamma ionizing effects than other transistor types. Experimental evidence is also presented which indicates that p channel MOS devices may be able to meet the requirements. Author

N72-17664*# Oak Ridge National Lab., Tenn.
EXPERIMENTAL NUCLEAR CROSS SECTIONS FOR SPACECRAFT SHIELD ANALYSIS c24
R. W. Peelle *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 488-499 refs Sponsored by NASA and AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18F

Experiments have been performed to validate and to supplement the intranuclear cascade model as a method for estimating cross sections of importance to spacecraft shield design. The experimental situation is in conclusive particularly for neutron-producing reactions, but is relatively sound for reaction cross sections and for proton spectra at several hundred MeV at medium forward angles. Secondary photon contributions are imprecisely known. Author

N72-17665*# Gulf Radiation Technology, San Diego, Calif.
MEASUREMENTS OF GAMMA-RAY PRODUCTION CROSS SECTIONS FOR SHIELDING MATERIALS OF SPACE NUCLEAR SYSTEMS
V. J. Orphan, Joseph John, and C. G. Hoot *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 500-511 refs Sponsored in part by AEC Prepared for Union Carbide Corp. (See N72-17601 08-22)
(Contracts DASA01-69-C-0083; UC-3032)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18F

Measurements of secondary gamma ray production from neutron interactions have been made over the entire energy range of interest in shielding applications. The epithermal capture gamma ray yields for both resolved gamma ray lines and continuum have been measured from thermal energies to 100 KeV for natural tungsten and U-238, two important candidate shield materials in SNAP reactor systems. Data are presented to illustrate the variation of epithermal capture gamma ray yields with neutron energy. The gamma ray production cross sections from (n,xy) reactions have been measured for Fe and Al from the threshold energies for inelastic scattering to approximately 16 MeV. Typical Fe and Al cross sections obtained with high-neutron energy resolution and averaged over broad neutron-energy groups are presented. Author

N72-17666*# Oak Ridge National Lab., Tenn.
THE POPOP4 LIBRARY AND CODES FOR PREPARING SECONDARY GAMMA-RAY PRODUCTION CROSS SECTIONS c24
W. E. Ford, III *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 512-519 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

The POPOP4 code for converting secondary gamma ray yield data to multigroup secondary gamma ray production cross sections and the POPOP4 library of secondary gamma ray yield data are described. Recent results of the testing of uranium and iron data sets from the POPOP4 library are given. The data sets were tested by comparing calculated secondary gamma ray pulse height spectra measured at the ORNL TSR-II reactor. Author

N72-17667*# California Univ., Irvine.
NEUTRONS PRODUCED BY KNOWN ENERGIES OF IONS ABUNDANT IN SPACE c29
William W. Wadman, III *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 520-522 refs Sponsored by AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

Particle accelerator radiation measurements are applied to the problem of calculating biological dose from radiation produced in the walls of a spacecraft by various ions in space. Neutrons, one of the products of the interactions of energetic ions with matter, are usually quite penetrating and have large values of Q.F. or R.B.E. Ions of helium, boron, carbon, nitrogen, and oxygen were accelerated and directed onto target materials of copper or tantalum. The secondary neutron production was determined. Studies were made of the angular distribution and an inferred neutron spectrum was calculated from activities of threshold reaction detectors. Author

N72-17668*# Princeton-Pennsylvania Accelerator, Princeton, N.J.
ACCELERATOR MEASUREMENT OF THE ENERGY SPECTRA OF NEUTRONS EMITTED IN THE INTERACTION OF 3-GeV PROTONS WITH SEVERAL ELEMENTS c24
W. J. Nalesnik, T. J. Devlin (Rutgers Univ., New Brunswick, N. J.), M. Merker, and B. S. P. Shen *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 523-526 refs Prepared in cooperation with Pa. Univ. (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

The application of time of flight techniques for determining the shapes of the energy spectra of neutrons between 20 and 400 MeV is discussed. The neutrons are emitted at 20, 34, and 90 degrees in the bombardment of targets by 3 GeV protons. The targets used are carbon, aluminum, cobalt, and platinum with cylindrical cross section. Targets being bombarded are located in the internal circulating beam of a particle accelerator. Author

N72-17669*# Purdue Univ., Lafayette, Ind.
THE CALCULATION OF NEUTRON CAPTURE GAMMA-RAY YIELDS FOR SPACE SHIELDING APPLICATIONS c24
K. J. Yost *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 527-529 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18F

The application of nuclear models to the calculation of neutron capture and inelastic scattering gamma yields is discussed. The gamma ray cascade model describes the cascade process in terms of parameters which either: (1) embody statistical assumptions regarding electric and magnetic multipole transition strengths, level densities, and spin and parity distributions or (2) are fixed by experiment su ch as measured energies, spin and parity values, and transition probabilities for low lying states. Author

N72-17670*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
LOW-ENERGY PARTICLE RADIATION ENVIRONMENT AT SYNCHRONOUS ALTITUDE c29
E. G. Shelley and S. K. Lens *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 530-538 refs Supported in part by the Lockheed Independent Res. Program (See N72-17601 08-22)
(Contract NAS5-10392)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

The degradation of thermal control coatings of satellites due to the effects of low energy charged particles in the space environment is discussed. Data obtained from ATS-5 satellite measurement of proton and electron fluxes are presented. The variations in electron density, proton density, and magnetic activity are presented to show correlations which exist between these space factors. Author

N72-17671*# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
NATURAL VARIATIONS IN THE GEOMAGNETICALLY TRAPPED ELECTRON POPULATION c29
A. L. Vampola *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 539-547 refs (See N72-17601 08-22)
(Contract F04701-70-C-0059)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

Temporal variations in the trapped natural electron flux intensities and energy spectra are discussed and demonstrated using recent satellite data. These data are intended to acquaint

the space systems engineer with the types of natural variations that may be encountered during a mission and to augment the models of the electron environment currently being used in space system design and orbit selection. An understanding of the temporal variations which may be encountered should prove helpful. Some of the variations demonstrated here which are not widely known include: (1) addition of very energetic electrons to the outer zone during moderate magnetic storms: (2) addition of energetic electrons to the inner zone during major magnetic storms; (3) inversions in the outer zone electron energy spectrum during the decay phase of a storm injection event and (4) occasional formation of multiple maxima in the flux vs altitude profile of moderately energetic electrons. Author

N72-17672*# Atomic Energy Commission, Washington, D.C.
TRAPPING OF TRANSURANIUM ELEMENTS BY THE EARTH'S MAGNETIC FIELD **c13**
Justin L. Bloom and Bernard J. Eastlund *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 548-555 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

The search for a transuranium element component of cosmic radiation has been carried out in high altitude balloon experiments. The trapping of high Z elements on orbits in the Earth's magnetic field may lead to a sufficient enhancement of the intensity of particle flux to make it possible to detect these elements by satellite experiments. Calculations are presented that predict the behavior of trapped particles as a function of the predicted flux and energy distribution of high Z elements incident on the Earth's magnetic field. Techniques are suggested for the detection of such particles. In addition, the possibility of production of transuranium elements in the recently discovered pulsars are discussed. Author

N72-17673*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JUPITER RADIATION BELT ENGINEERING MODEL **c29**
Neil Divine *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 556-560 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

On the basis of earth observations of the HF and UHF radio emission generated near Jupiter, the presence of energetic charged particles trapped in the planet's dipole magnetic field has been inferred. For electrons, energies of the order of 10 MeV and peak fluxes of the order of 10 to the 7th power per square centimeter per second can be derived from the data for equatorial regions about two planetary radii from the dipole. Energetic protons and lower-energy electrons and protons are also expected, but the limited data require that their fluxes be based on theory or earth analogy. Because descriptions available in the literature suggest large associated uncertainties, both nominal and limiting models for the charged-particle populations of Jupiter's belts are derived. These new engineering models describe electron and proton fluxes and their distributions in energy and position in forms suitable as space vehicle design criteria. Author

N72-17674*# Air Force Weapons Lab., Kirtland AFB, N.Mex. Technology Div.
A SUMMARY OF THE OV1-19 SATELLITE DOSE, DEPTH DOSE, AND LINEAR ENERGY TRANSFER SPECTRAL MEASUREMENTS **c24**
John T. Cervini *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 561-568 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

Measurements of the biophysical and physical parameters in the near earth space environment, specifically, the Inner Van Allen Belt are discussed. This region of space is of great interest to planners of the Skylab and the Space Station programs because of the high energy proton environment, especially during periods of increased solar activity. Many physical measurements of charged particle flux, spectra, and pitch angle distribution have been conducted and are programmed in the space radiation environment. Such predictions are not sufficient to accurately predict the effects of space radiations on critical biological and electronic systems operating in these environments. Some of the difficulties encountered in transferring from physical data to a prediction of the effects of space radiation on operational systems are discussed. Author

N72-17675*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN CONSIDERATIONS AND TEST FACILITIES FOR ACCELERATED RADIATION EFFECTS TESTING **c11**
William E. Price, Charles G. Miller, and Richard H. Parker *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 570-576 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

Test design parameters for accelerated dose rate radiation effects tests for spacecraft parts and subsystems used in long term mission (years) are detailed. A facility for use in long term accelerated and unaccelerated testing is described. Author

N72-17676*# Air Force Cambridge Research Labs., Bedford, Mass.
SOLAR CELL RADIATION RESPONSE NEAR THE INTERFACE OF DIFFERENT ATOMIC NUMBER MATERIALS **c03**
E. A. Burke, J. R. Cappelli, L. F. Lowe, and J. A. Wall *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 577-583 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 10A

The response of cobalt 60 irradiated N/P silicon solar cells was measured as a function of the atomic number of the medium adjacent to the cell and the direction of the gamma ray beam. The interpositioning of various thicknesses of aluminum between the adjacent material and the cell had the effect of moving the cell to various locations in an approximate monatomic numbered medium. Using this technique the solar cell response was determined at various distances from the interface for gold and beryllium. The results were compared with predictions based upon ionization chamber measurements of dose perturbations in aluminum and found to agree within five percent. Ionization chamber data was then used to estimate the influence of various base contact materials. Author

N72-17677*# Brookhaven National Lab., Upton, N.Y.
MICROSCOPIC OBSERVATIONS OF X-RAY AND GAMMA-RAY INDUCED DECOMPOSITION OF AMMONIUM PERCHLORATE CRYSTALS **c26**
P. J. Herley (Picatinny Arsenal) and P. W. Levy *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 584-594 refs Supported in part by Picatinny Arsenal and AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20L

The X-ray and gamma-ray induced decomposition of ammonium perchlorate was studied by optical, transmission, and scanning electron microscopy. This material is a commonly used oxidizer in solid propellents which could be employed in deep-space probes, and where they will be subjected to a variety of radiations for as long as ten years. In some respects the radiation-induced damage closely resembles the effects produced by thermal decomposition, but in other respects the results differ markedly. Similar radiation and thermal effects include the following: (1) irregular or ill-defined circular etch pits are formed in both cases; (2) approximately the same size pits are produced; (3) the pit density is similar; (4) the c face is considerably more reactive than the m face; and (5) most importantly, many of the etch pits are aligned in crystallographic directions which are the same for thermal or radiolytic

decomposition. Thus, dislocations play an important role in the radiolytic decomposition process. Author

N72-17678*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
IRRADIATION EFFECTS STUDIES OF NERVA MATERIALS **c18**
J. A. DeMastry and T. P. Merrick *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 595-602 Sponsored by AEC and NASA Prepared for Aerojet Nucl. Systems Co. (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 11D

Several materials used in the NERVA project were irradiated at cryogenic temperatures to neutron fluences between 10 to the 17th and 10 to the 19th power newtons per square centimeter. Tensile properties were determined over a temperature range to evaluate the effects of irradiation on the material properties. The expe cted radiation damage typical of other materials was observed. A general increase in strength and decrease in ductility occurred. The effects at liquid nitrogen temperatures are more pronounced since radiation induced defects are not annealed out. Author

N72-17679*# National Aeronautics and Space Administration, Washington, D.C.
EFFECT OF CRYOGENIC IRRADIATION ON NERVA STRUCTURAL ALLOYS **c17**
C. E. Dixon, M. J. Davidson, and C. W. Funk *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 603-608 (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 11F

Several alloys (Hastelloy X, AISI 347, A-286 bolts, Inconel 718, Al 7039-T63 and Ti-5Al-2.5Sn ELI) were irradiated in liquid nitrogen (140 R) to neutron fluences between 10 to the 17th power and 10 to the 19th power nvt (E greater than 1.0 Mev). After irradiation, tensile properties were obtained in liquid nitrogen without permitting any warmup except for some specimens which were annealed at 540 R. The usual trend of radiation damage typi cal for materials irradiated at and above room temperature was observed, such as an in crease in strength and decrease in ductility. However, the damage at 140 R was greater be cause this temperature prevented the annealing of radiation-indu ced defe cts whi ch o c curs above 140 R. Author

N72-17680*# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
A PORTABLE ABSORBED DOSE MEASURING INSTRUMENT WITH GAMMA DISCRIMINATION **c14**
W. M. Quam and W. I. Wilde *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 609-613 (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

The characteristics of an electronic instrument for measuring the radiation dose absorbed by tissues are presented. The detector is a sphere of tissue-equivalent plastic with a single wire located on a diameter of the sphere. The electronic circuits and method of operation of the detector are described. Advantages are the small size and easy portability plus ability to selectively measure neutron and gamma plus neutron events. Author

N72-17681*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
A COMPTON SCATTER ATTENUATION GAMMA RAY SPECTROMETER **c14**
W. E. Austin *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 614-617 refs (See N72-17601 08-22)
(Contract NAS8-25617)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

A Compton scatter attenuation gamma ray spectrometer conceptual design is discussed for performing gamma spectral measurements in monodirectional gamma fields from 100 R per hour to 1,000,000 R per hour. Selectable Compton targets are used to scatter gamma photons onto an otherwise heavily shielded detector with changeable scattering efficiencies such that the count rate is maintained between 500 and 10,000 per second. Use of two sum-Compton coincident detectors, one for energies up to 1.5 MeV and the other for 600 keV to 10 MeV, will allow good peak to tail pulse height ratios to be obtained over the entire spectrum and reduces the neutron recoil background rate. Author

N72-17682*# White Sands Missile Range, N.Mex. Nuclear Weapons Effects Div.
SPACE RADIATION STUDIES AT THE WHITE SANDS MISSILE RANGE FAST BURST REACTOR **c11**
A. DeLaPaz *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 618-619 (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

The operation of the White Sands Missile Range Fast Burst Reactor is discussed. Space radiation studies in radiobiology, dosimetry, and transient radiation effects on electronic systems and components are described. Proposed modifications to increase the capability of the facility are discussed. Author

N72-17683*# National Cancer Inst., Bethesda, Md.
FACTORS MODIFYING THE RESPONSE OF LARGE ANIMALS TO LOW-INTENSITY RADIATION EXPOSURE **c04**
Norbert P. Page and Edwin T. Still (AEC, Washington, D. C.) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 622-632 refs Prepared in cooperation with AEC, Washington, D. C. (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

In assessing the biological response to space radiation, two of the most important modifying factors are dose protraction and dose distribution to the body. Studies are reported in which sheep and swine were used to compare the hematology and lethality response resulting from radiation exposure encountered in a variety of forms, including acute (high dose-rate), chronic (low dose-rate), combinations of acute and chronic, and whether received as a continuous or as fractionated exposure. While sheep and swine are basically similar in response to acute radiation, their sensitivity to chronic irradiation is markedly different. Sheep remain relatively sensitive as the radiation exposure is protracted while swine are more resistant and capable of surviving extremely large doses of chronic irradiation. This response to chronic irradiation correlated well with changes in radiosensitivity and recovery following an acute, sublethal exposure. Author

N72-17684*# Los Alamos Scientific Lab., N.Mex.
EFFECT OF CONTINUOUS GAMMA-RAY EXPOSURE ON PERFORMANCE OF LEARNED TASKS AND EFFECT OF SUBSEQUENT FRACTIONATED EXPOSURES ON BLOOD-FORMING TISSUE **c04**
J. F. Spalding, L. M. Holland, J. R. Prine, D. N. Farrer (Aeromed. Res. Lab. (6571st), Holloman AFB, N. Mex.), and R. G. Braun (Aeromed. Res. Lab. (6571st), Holloman AFB, N. Mex.) *In* NASA, Washington Pro c. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 633-640 refs Supported by AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

Sixteen monkeys trained to perform continuous and discrete-avoidance and fixed-ratio tasks with visual and auditory cues were performance-tested before, during, and after 10-day gamma-ray exposures totaling 0, 500, 750, and 1000 rads. Approximately 14 months after the performance-test exposures, surviving animals were exposed to 100-rad gamma-ray fractions at 56-day intervals to observe injury and recovery patterns of blood-forming tissues. The fixed-ratio, food-reward task performance showed a transient decline in all dose groups within

24 hours of the start of gamma-ray exposure, followed by recovery to normal food-consumption levels within 48 to 72 hours. Avoidance tasks were performed successfully by all groups during the 10-day exposure, but reaction times of the two higher dose-rate groups in which animals received 3 and 4 rads per hour or total doses of 750 and 1000 rads, respectively, were somewhat slower. Author

N72-17685*# Civil Aeromedical Inst., Oklahoma City, Okla.
RELATIVE BIOLOGICAL EFFECTIVENESS OF FAST NEUTRONS COMPARED WITH X-RAYS: PRENATAL MORTALITY IN THE MOUSE c04
W. Friedberg, G. D. Hanneman, D. N. Faulkner, and E. B. Darden, Jr. (ORNL) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 641 (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

The effects of fission neutrons and of X-rays on the mouse zygote are discussed. Seven-week-old virgin mice were allowed a 12-hour mating opportunity beginning at 7:00 P.M. Between 1:30 and 4:00 P.M., except where indicated otherwise, the females which had mated (vaginal plug) during the night were either irradiated or sham-irradiated. At the time of irradiation the zygotes were in a pronuclear stage. Sixteen days later the mice were killed and the uteri dissected. The number of dead embryos, live embryos, and gross anomalies were determined. Dead embryos were classified as to stage of development. Author

N72-17686*# Kansas Univ., Kansas City. Medical Center.
PROTON IRRADIATION OF STEM CELLS: RADIATION DAMAGE AND CHEMICAL RADIOPROTECTION c04
Richard C. Riley, James L. Montour, and Clifford W. Gurney (Med. Coll. of Va.) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 642-646 refs Prepared in cooperation with Med. Coll. of Va., Richmond. Div. of Radiation Biol. (See N72-17601 08-22)
(Grants NGR-47-002-018; AM-14377-02)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

Effects of high energy protons on erythropoietic stem cells and radioprotection by chemicals were investigated in NASA Space Radiation Effects Laboratory. The effects of a parallel beam of 600 MeV protons. The fluence, when converted to dose, were referenced to the synchrocyclotron beam monitors which were then used to administer radiation exposures. Mice were given graded doses to 300 rads to determine dose-response curve. Other mice received saline, AET, or 5-hydroxytryptamine 10 to 15 minutes before exposure. Author

N72-17687*# Michigan Univ., Ann Arbor. Dept. of Zoology.
RADIATION CARCINOGENESIS AND ACUTE RADIATION MORTALITY IN THE RAT AS PRODUCED BY 2.2 GeV PROTONS c04
C. J. Shellabarger, R. F. Straub, J. E. Jesseph, and J. L. Montour *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 647-651 refs Prepared in cooperation with Brookhaven Natl. Lab., Upton, N. Y. Med. Dept. (See N72-17601 08-22)
(Grant NGR-23-005-009)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

Biological studies, proton carcinogenesis, the interaction of protons and gamma-rays on carcinogenesis, proton-induced acute mortality, and chemical protection against proton-induced acute mortality were studied in the rat and these proton-produced responses were compared to similar responses produced by gamma-rays or X-rays. Litter-mate mice were assigned to each experimental and control group so that approximately equal numbers of litter mates were placed in each group. Animals to be studied for mammary neoplasia were handled for 365 days post-exposure when all animals alive were killed. All animals were examined frequently for mammary tumors and as these were found, they were removed, sectioned and given a pathologic classification. Author

N72-17688*# California Univ., Berkeley. Lawrence Radiation Lab.
RESPONSE OF MOUSE EPIDERMAL CELLS TO SINGLE DOSES OF HEAVY-PARTICLES c04
J. T. Leith, W. A. Schilling, and G. P. Welch *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 652-658 refs Prepared in cooperation with Calif. Univ., Berkeley. Donner Lab. (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

The survival of mouse epidermal cells to heavy-particles has been studied In Vivo by the Withers clone technique. Experiments with accelerated helium, lithium and carbon ions were performed. The survival curve for the helium ion irradiations used a modified Bragg curve method with a maximum tissue penetration of 465 microns, and indicated that the dose needed to reduce the original cell number to 1 surviving cell/square centimeters was 1525 rads with a D sub o of 95 rads. The LET at the basal cell layer was 28.6 keV per micron. Preliminary experiments with lithium and carbon used treatment doses of 1250 rads with LET's at the surface of the skin of 56 and 193 keV per micron respectively. Penetration depths in skin were 350 and 530 microns for the carbon and lithium ions whose Bragg curves were unmodified. Results indicate a maximum RBE for skin of about 2 using the skin cloning technique. An attempt has been made to relate the epidermal cell survival curve to mortality of the whole animal for helium ions. Author

N72-17689*# Medical Coll. of Virginia, Richmond. Dept. of Radiology.
LYMPHATIC INVOLUTION AND EARLY MORTALITY IN THE YOUNG CHICKEN PRODUCED BY 2.2 GeV PROTONS c04
James L. Montour and Claire J. Shellabarger *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 659-663 Supported in part by AEC (See N72-17601 08-22)
(Grant NGR-23-005-009)

Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

Young single-comb white Leghorn cockerels were subjected to single acute doses of either 2.2 GeV protons or 250 kVp X-rays. Since young chickens exposed in the lethal range die within 48 hours of exposure, an hourly tabulation of deaths was recorded for this length of time after exposure. Animals which were exposed to sublethal doses were killed five days after exposure and their major lymphatic organs, (thymus, bursa, and spleen), removed and weighed. In the lethal range, animals exposed to 2.2 GeV protons died sooner than those receiving similar doses of X-rays, but total mortality was similar in each case at similar dose levels. The 48 hour LD sub 50 was determined to be 710 rad. Measured five days after exposure, 50% depression ED sub 50 for lymphatic organs occurred as follows: (1) thymus, 350 rad; (2) pursa, 500 rad, and (3) spleen, 450 rad. In all case R.B.E. values were not different from unity. Author

N72-17690*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF THE HAZARD FROM EXPOSURE TO ELECTRON IRRADIATION SIMULATING THAT IN THE SYNCHRONOUS ORBIT c04
Stuart W. Lippincott, Trutz Foelsche, James L. Montour, Roger Bender, and John Wilson *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 665-671 ref Prepared in cooperation with Med. Coll. of Va. and the Citadel, Charleston, S. C. (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

The electron spectrum predicted for the synchronous orbit was simulated to determine the effects that might occur to astroscientists exposed to such irradiation while on a prolonged space station mission in that region. Miniature pigs were exposed to monoenergetic and spectral-fractionated irradiations with 0.5 to 2.1 MeV electrons. Clinical and pathological alterations observed in biopsies were correlated with depth-dose

pattern and length of post irradiation period up to one year. With monoenergetic electrons, the lowest dose causing a recognizable lesion was 1450 rad and with increasing dose lesions appeared earlier and were more severe. At the highest dose given, 2650 rad, ulceration extending into the dermis was present by twenty one days and required about four months for complete healing. Spectral-fractionated irradiations, in which the total dose range was essentially comparable to that of the monoenergetic series, resulted in very minimal outer dermis edema at 1790 rad and at no dose employed did necrosis of epidermis or ulceration into dermis occur. Author

N72-17691*# Oak Ridge National Lab., Tenn.
APPLICATION OF DOT-MORSE COUPLING TO THE ANALYSIS OF THREE-DIMENSIONAL SNAP SHIELDING PROBLEMS
E. A. Straker, R. L. Childs, and M. B. Emmett *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 674-680 refs Sponsored by AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18N

The use of discrete ordinates and Monte Carlo techniques to solve radiation transport problems is discussed. A general discussion of two possible coupling schemes is given for the two methods. The calculation of the reactor radiation scattered from a docked service and command module is used as an example of coupling discrete ordinates (DOT) and Monte Carlo (MORSE) calculations. Author

N72-17692*# Aerojet Nuclear Systems Co., Sacramento, Calif.
DISCRETE ORDINATES-MONTE CARLO COUPLING: A COMPARISON OF TECHNIQUES IN NERVA RADIATION ANALYSIS
D. G. Lindstrom, E. Normand, and A. D. Wilcox *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 681-686 refs Sponsored by NASA and AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18H

In the radiation analysis of the NERVA nuclear rocket system, two-dimensional discrete ordinates calculations are sufficient to provide detail in the pressure vessel and reactor assembly. Other parts of the system, however, require three-dimensional Monte Carlo analyses. To use these two methods in a single analysis, a means of coupling was developed whereby the results of a discrete ordinates calculation can be used to produce source data for a Monte Carlo calculation. Several techniques for producing source detail were investigated. Results of calculations on the NERVA system are compared and limitations and advantages of the coupling techniques discussed. Author

N72-17693*# Oak Ridge National Lab., Tenn.
MORSE MONTE CARLO SHIELDING CALCULATIONS FOR THE ZIRCONIUM HYDRIDE REFERENCE REACTOR
C. E. Burgart *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 687-691 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18F

Verification of DOT-SPACETRAN transport calculations of a lithium hydride and tungsten shield for a SNAP reactor was performed using the MORSE (Monte Carlo) code. Transport of both neutrons and gamma rays was considered. Importance sampling was utilized in the MORSE calculations. Several quantities internal to the shield, as well as dose at several points outside of the configuration, were in satisfactory agreement with the DOT calculations of the same. Author

N72-17694*# Aerojet Nuclear Systems Co., Sacramento, Calif. Nuclear Science Section.
APPLICATION OF MORSE TO RADIATION ANALYSIS OF NUCLEAR FLIGHT PROPULSION MODULES
W. A. Woolson *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 692-696 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18E

Several modifications and additions were made to the multigroup Monte Carlo code (MORSE) to implement its use in a computational procedure for performing radiation analyses of NERVA nuclear flight propulsion modules. These changes include the incorporation of a new general geometry module; the inclusion of an expectation tracklength estimator; and the option to obtain source information from two-dimensional discrete ordinates calculations. Computations comparing MORSE and a point cross section Monte Carlo code, COHORT, were made in which a coupled discrete ordinates/Monte Carlo procedure was used to calculate the gamma dose rate at tank top locations of a typical propulsion module. The dose rates obtained from the MORSE computation agreed with the dose rates obtained from the COHORT computation to within the limits of the statistical accuracy of the calculations. Author

N72-17695*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SHIELD WEIGHT OPTIMIZATION USING MONTE CARLO TRANSPORT CALCULATIONS
Thomas M. Jordan (ART Res. Corp.) and Millard L. Wohl *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 697-705 refs Prepared in cooperation with ART Res. Corp. (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18F

Outlines are given of the theory used in FASTER-3 Monte Carlo computer program for the transport of neutrons and gamma rays in complex geometries. The code has the additional capability of calculating the minimum weight layered unit shield configuration which will meet a specified dose rate constraint. It includes the treatment of geometric regions bounded by quadratic and quardric surfaces with multiple radiation sources which have a specified space, angle, and energy dependence. The program calculates, using importance sampling, the resulting number and energy fluxes at specified point, surface, and volume detectors. Results are presented for sample problems involving primary neutron and both primary and secondary photon transport in a spherical reactor shield configuration. These results include the optimization of the shield configuration. Author

N72-17696*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE RESPONSE OF A 300 MICRON SILICON DETECTOR TO MONOENERGETIC NEUTRONS DETERMINED BY THE USE OF THE MONTE CARLO TECHNIQUE c24
M. Tahezadeh and G. Anno (Art Corp.) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 708-713 refs (See N72-17601 08-22) (Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

The response of a 300 micron thick silicon detector to an incident monoenergetic neutron beam is evaluated by the Monte Carlo method for the cases of both a shielded and a bare detector. The result of Monte Carlo calculation, using elastic, inelastic, and absorption reactions indicates that the response of the silicon detector to neutrons is basically due to the elastic scattering. In addition, the gamma rays generated in the shield of the detector will result in a response which is 3 or 4 orders of magnitude smaller than response to incident photons. The response of a bare silicon detector is calculated for neutron energies up to 6 MeV and bias energies from 50 to 250 KeV. It is found that the maximum response for a 300 micron thick silicon detector is less than .004 c/n within this selected neutron and bias energy range. When the pulse height defect is introduced in the calculation the results at low energy neutrons were reduced. Author

N72-17697*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IDENTIFICATION AND CONTROL OF SPACECRAFT

RADIATION SOURCES OF INTERFERENCE TO X-RAY AND GAMMA-RAY EXPERIMENTS c31

Albert E. Metzger (JPL) and Jacob I. Trombka *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 714-722 refs Prepared in cooperation with JPL (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22B

Apollo 15 and 16 will carry instruments for the purpose of measuring X-ray and gamma ray fluxes from the lunar surface and in cis-lunar space. The intensity levels expected are low over most of the energy range of interest, requiring that background contributions be minimized. The radiation sources on Apollo determined and their interference with these instruments evaluated. The results were used as a basis for dealing with this problem and for recommendations applicable to future manned and unmanned missions. Author

N72-17698*# Teledyne Isotopes, Westwood, N.J.

A HIGH RESOLUTION SEMICONDUCTOR DETECTOR FOR APPLICATIONS IN SPACE c14

Peter Alexander and Herman Shulman *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 723-728 refs (See N72-17601 08-22)
(Contracts NAS1-6654; DASA01-70-C-0040)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

Nuclear radiation detectors with volumes of approximately 1 cu cm was fabricated from single crystals of germanium-silicon alloy containing as much as 20 weight percent germanium. The properties of these detectors were investigated and will be discussed. Tests reveal that the gamma ray photoelectric peak efficiency of an alloy detector with only 12 weight percent germanium is approximately 4 times that of a silicon detector of equal volume. The room temperat roomure appears to be a good possibility. Storage for long periods at room temperature does not seem to adversely affect these devices. The results of preliminary radiation damage experiments suggest that the alloy detectors possess a radiation damage resistance far greater than that of silicon. Author

N72-17699*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

RADIATION EFFECTS ON SCIENCE INSTRUMENTS IN GRAND TOUR TYPE MISSIONS c14

Richard H. Parker *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 729-734 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

The extent of the radiation effects problem is delineated, along with the status of protective designs for 15 representative science instruments. Designs for protecting science instruments from radiation damage is discussed for the various instruments to be employed in the Grand Tour type missions. A literature search effort was undertaken to collect science instrument components damage/interference effects data on the various sensitive components such as Si detectors, vidicon tubes, etc. A small experimental effort is underway to provide verification of the radiation effects predictions. Author

N72-17700*# Aerojet Electrosystems Co., Azusa, Calif.

RADIATION NOISE IN A HIGH SENSITIVITY STAR SENSOR c14

J. B. Parkinson and E. Gordon *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 735-743 refs Sponsored by SAMSO (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

An extremely accurate attitude determination was developed for space applications. This system uses a high sensitivity star sensor in which the photomultiplier tube is subje ct to noise generated by space radiations. The space radiation induced noise arises from trapped electrons, solar protons and other ionizing radiations, as well as from dim star background. The solar activity and hence the electron and proton environments are predicted through the end of the twentieth century. The available data for the response of the phototube to proton, electron, gamma ray, and bremsstrahlung radiations are reviewed and new experimental data is presented. A simulation was developed which represents the characteristics of the effect of radiations on the star sensor, including the non-stationarity of the backgrounds. Author

N72-17701*# McClellan AFB, Calif.

GE(LI) DATA REDUCTION USING SMALL COMPUTERS c08

W. E. McDermott *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 744-746 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 09B

The advantages and limitations of using a small computer to analyze Ge(Li) radiation spectra are studied. The computer has to: (1) find the spectrum peaks, (2) determine the count rate in the photopeaks, and (3) relate the count rate to known gamma transitions to find the amount of each radionuclide present. Results show that tasks one and two may be done by the computer but task three must be done by an experimenter or a larger computer. E.H.W.

N72-17702*# Martin Marietta Corp., Denver, Colo.

RADIATION PROBLEMS ASSOCIATED WITH SKYLAB c31

John E. Braly and Thomas R. Heaton *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 748-755 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22B

Radiation tests were conducted on the various types of Skylab film to establish the total radiation dosages compatible with an acceptable level of film fogging, and on the S190 borosilicate window to establish radiation limits for an acceptable darkening level. The results verified that most of the films would be unusable when returned to earth, and that the borosilicate window would be darkened beyond allowable limit, unless additional protection was provided. The operational solutions to these problems involve protecting the film with five film vaults and protecting the window with a radiation shield. The largest vault is made of aluminum and weighs over 2000 lb (its thickest compartment wall is 3.4 in.). The window radiation shield is a light honeycomb structure which is swung away for limited astronaut viewing or when the S190 experiment is in operation. Although the shield is light weight, it is heavy enough to stop the large number of low energy electrons making up a major part of the external environment and which are potentially damaging to the window. A brief description is given of the Skylab mission and some of the associated experiments. The radiation environment the spacecraft will encounter is discussed. Author

N72-17703*# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Physics.

FREQUENCY OF LIGHT-FLASHES INDUCED BY CERENKOV RADIATION FROM HEAVY COSMIC-RAY NUCLEI c29

Richard Madey and P. J. McNulty *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 757-766 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

The expected frequency was calculated for light flashes induced in the dark-adapted eye by Cerenkov radiation from the flux of heavy nuclei that exists in space beyond the geomagnetic field. The expected frequency of light flashes depends on the threshold number of photons that must be absorbed in a rod cluster. The results of the calculation are presented as a curve of the mean frequency of light flashes versus the threshold number of absorbed photons. The results are not sensitive to variations in the path length from 5 to 15 grams per square centimeter of

water-equivalent before the nucleus reaches the retina. Calculations were based on the fluxes and energy spectra of galactic cosmic ray nuclei of helium to iron, measured at a time of minimum solar modulation. The expected light flash frequencies induced by Cerenkov radiation are consistent with the frequencies reported by the astronauts on Apollo missions 11 through 14. Author

N72-17704*# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Physics.
DIRECT STIMULATION OF THE RETINA BY THE METHOD OF VIRTUAL-QUANTA FOR HEAVY COSMIC-RAY NUCLEI c29
P. J. McNulty and Richard Madey *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radition in Space Jan. 1972 p 767-772 refs Sponsored by Res. Corp., AFCRL, and NAS-NRC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

The contribution to the frequency of visual sensations induced in the dark-adapted eye by the virtual photon field was calculated, this field is associated with the heavy nuclei that exist in space beyond the geomagnetic field. In order to determine the probability that the virtual photon field induces a light flash, only the portion of the virtual photon spectrum that corresponds to the known frequency dependence of the sensitivity of human rods to visible light was utilized. The results can be expressed as a curve of the mean frequency of light flashes induced by the absorption of at least R virtual photons versus the threshold number R. The contribution to the light flash frequency from the virtual photon field of heavy cosmic ray nuclei is smaller than that from Cerenkov photons. The flux and energy spectra of galactic cosmic ray nuclei helium to iron were used. Author

N72-17705*# Martin Marietta Corp., Denver, Colo.
INFLUENCE OF A DETAILED MODEL OF MAN ON PROTON DEPTH/DOSE CALCULATION c04
Paul G. Kase *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 773-780 refs Sponsored by NASA and Air Force (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

The development of a detailed radiation shielding model of man is discussed. This model will be used to plan for manned space missions in which sensitive human tissues may be subjected to excessive radiation. The model has two configurations: standing and seated. More than 2500 individual elements were used to depict the external conformation, skeleton, and principal organs. The model is briefly described and several examples of its application to mission planning are given. Author

N72-17706*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JUPITER RADIATION TEST LEVELS AND THEIR EXPECTED IMPACT ON AN ENCOUNTER MISSION c29
J. B. Barengoltz *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 781-784 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

The upper limit, of electron and proton fluences for a thermoelectric outer planet spacecraft mission in a near-Jupiter environment, for use as radiation design restraints, were extracted from a model of the Jovian trapped radiation belts. Considerations of radiation effects in semiconductor devices were employed to construct simplified radiation test levels based on the design restraints. Corresponding levels, based on the nominal belt models, are one to three orders of magnitude smaller. In terms of expected radiation-induced degradation in semiconductor devices, an encounter with an environment as severe as the design restraints would reguire hardening the system in order to guarantee high reliability. On the other hand, the nominal levels would only necessitate care in the selection of components and the avoidance of certain semiconductor components. Author

N72-17707*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
A MONTE CARLO PHOTOCURRENT/PHOTOEMISSION COMPUTER PROGRAM c08
W. L. Chadsey and C. Ragona *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 786-791 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 09B

A Monte Carlo computer program was developed for the computation of photo currents and photoemission in gamma (X-ray)-irradiated materials. The program was used for computation of radiation-induced surface currents on space vehicles and the computation of radiation-induced space charge environments within space vehicles. Author

N72-17708*# TRW Systems Group, Redondo Beach, Calif.
PHOTON INDUCED SECONDARY ELECTRON EMISSION c24
R. B. Spencer, C. B. Smith, and E. J. McGrath *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 792-800 refs Prepared in cooperation with Norman Eng. Co.and Sci. Appl., Inc. (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

Numerical models for predicting photon-induced secondary electron emission are presented. The results are compared with experimental measurements made using a Co-60 gamma ray source. Author

N72-17709*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRON AND BREMSSTRAHLUNG PENETRATION AND DOSE CALCULATION c24
John W. Watts, Jr. and Martin O. Burrell *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 801-815 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

Various techniques for the calculation of electron and bremsstrahlung dose deposition are described. Energy deposition, transmission, and reflection coefficients for electrons incident on plane slabs are presented, and methods for their use in electron dose calculations were developed. A method using the straight-ahead approximation was also developed, and the various methods were compared and found to be in good agreement. Both accurate and approximate methods of calculating bremsstrahlung dose were derived and compared. Approximation is found to give a good estimate of dose where the electron spectrum falls off exponentially with energy. Author

N72-17710*# Oak Ridge National Lab., Tenn.
LOW-ENERGY ELECTRON TRANSPORT WITH THE METHOD OF DISCRETE ORDINATES c24
D. E. Bartine, R. G. Alsmiller, Jr., F. R. Mynatt, W. W. Engle, Jr., and J. Barish *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 816-820 refs (See N72-17601 08-22)
(NASA Order H-38280a)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

The one-dimensional discrete ordinates code ANISN was adapted to transport low energy (a few MeV) electrons. Calculated results obtained with ANISN were compared with experimental data for transmitted electron energy and angular distribution data for electrons normally incident on aluminum slabs of various thicknesses. The calculated and experimental results are in good agreement for a thin slab (0.2 of the electron range), but not for the thicker slabs (0.6 of the electron range). Calculated results obtained with ANISN were also compared with results obtained using Monte Carlo methods. Author

N72-17711*# Brookhaven National Lab., Upton, N.Y.
THE APPLICATION OF THE PHASE SPACE TIME EVOLUTION METHOD TO ELECTRON SHIELDING c24
Matthew C. Cordaro (Long Island Lighting Co.) and Martin S. Zucker *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 821-831 refs Sponsored by AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

A computer technique for treating the motion of charged and neutral particles and called the phase space time evolution method was developed. This technique employs the computer's bookkeeping capacity to keep track of the time development of a phase space distribution of particles. This method was applied to a study of the penetration of electrons. A 1 MeV beam of electrons normally incident on a semi-infinite slab of aluminum was used. Results of the calculation were compared with Monte Carlo calculations and experimental results. Time-dependent PSTE electron penetration results for the same problem are presented. Author

N72-17712*# Science Applications, Inc., La Jolla, Calif.
PARAMETRIC FIT TO ELECTRON TRANSPORT PROPERTIES c24
J. A. Lonergan and D. C. Shreve *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 832-841 refs Sponsored by NASA (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

Experimental data acquired over the past few years were gathered, and parametric fits made to these data. The following properties of electron transport were represented by simple functions of atomic number and energy: transmitted electron number, transmitted electron spectra, range, backscatter coefficient, angular distribution, energy deposition, bremsstrahlung intensity and energy spectra, and bremsstrahlung angular distribution and photon attenuation. The formulas cover the energy ranges of interest in space shielding problems (0.1 to 10.0 MeV). Procedures for using these formulas in practical situations are suggested. Author

N72-17713*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN CONSIDERATIONS FOR COMBINED RADIATION EFFECTS FACILITIES FOR TWELVE YEAR OUTER PLANET SPACECRAFT VOYAGES c11
Charles G. Miller *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 844-849 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

The design considerations influencing the choice and utility of environmental simulation methods and facilities are described, insofar as they relate to the requirements imposed on outer planet spacecraft because of radiation environments to be expected. Possible means for duplicating the radioisotope thermoelectric generator radiation environment, and for duplicating the effects of the trapped radiation belt environment are described, together with an assessment of radiation levels to be expected in the vicinity of an environmental testing chamber when in use. Author

N72-17714*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DESIGN OF A SOURCE TO SIMULATE THE GAMMA-RAY SPECTRUM EMITTED BY A RADIOISOTOPE THERMOELECTRIC GENERATOR c03
Melvin Reier *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 850-852 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 10A

A simulated source was designed to duplicate the gamma spectrum of a uniform cylindrical 2200-watt PuO2 radioisotope thermoelectric generator containing 81% Pu-238 and 1.2 ppm Pu-236. Gamma rays from the decay of Pu-238, Am-241, Pu-239, and the O-18(alpha,n)Ne-21 reaction were catalogued in broad energy groups. Two 46- and one 22-mc Th-228 sources provided simulation at various times in the life of the fuel capsule up to 18 years, which covers the time span of an outer planet mission. Emission from Th-228 represents the overwhelming contribution of the gamma spectrum after the first few years. The sources, in the form of 13-inch rods, were placed in a concentric hole in a cylinder of depleted uranium, which provided shielding equivalent to the self-shielding of the fuel capsule. The thickness of the U-238 cylinder (0.55cm) was determined by Monte Carlo calculations to insure that the spectrum emerging from the simulated source matched that of the fuel capsule. Author

N72-17715*# Mound Lab., Miamisburg, Ohio.
SOME NEUTRON AND GAMMA RADIATION CHARACTERISTICS OF PLUTONIUM CERMET FUEL FOR ISOTOPIC POWER SOURCES
R. A. Neff, M. E. Anderson, A. R. Campbell, and F. X. Haas *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 853-858 (See N72-17601 08-22)
(Contract AT(33-1)-GEN-53)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18J

Gamma and neutron measurements on various types of plutonium sources are presented in order to show the effects of O-17, O-18 F-19, Pu-236, age of the fuel, and size of the source on the gamma and neutron spectra. Analysis of the radiation measurements shows that fluorine is the main contributor to the neutron yields from present plutonium-molybdenum cermet fuel, while both fluorine and Pu-236 daughters contribute significantly to the gamma ray intensities. Author

N72-17716*# Los Alamos Scientific Lab., N.Mex.
RADIATION FROM PLUTONIUM 238 USED IN SPACE APPLICATIONS
T. K. Keenan, R. E. Vallee (Mound Lab., Miamisburg, Ohio), and J. A. Powers (AEC) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade. Radiation in Space Jan. 1972 p 859-861 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18J

The principal mode of the nuclear decay of plutonium 238 is by alpha particle emission at a rate of 17 curies per gram. Gamma radiation also present in nuclear fuels arises primarily from the nuclear de-excitation of daughter nuclei as a result of the alpha decay of plutonium 238 and reactor-produced impurities. Plutonium 238 has a spontaneous fission half life of 4.8 x 10 to the 10th power years. Neutrons associated with this spontaneous fission are emitted at a rate of 28,000 neutrons per second per gram. Since the space fuel form of plutonium 238 is the oxide pressed into a cermet with molybdenum, a contribution to the neutron emission rate arises from (alpha, n) reactions with O-17 and O-18 which occur in natural oxygen. Author

N72-17717*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NUCLEAR RADIATION ENVIRONMENT ANALYSIS FOR THERMOELECTRIC OUTER PLANET SPACECRAFT c31
H. S. Davis and E. F. Koprowski (ART Res. Corp.) *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 862-865 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22B

Neutron and gamma ray transport calculations were performed using Monte Carlo methods and a three-dimensional geometric model of the spacecraft. The results are compared with similar calculations performed for an earlier design. Author

N72-17718*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE PROGRAM AT JPL TO INVESTIGATE THE NUCLEAR

INTERACTION OF RTG'S WITH SCIENTIFIC INSTRUMENTS ON DEEP SPACE PROBES c03

Vincent Truscello *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 866-873 refs (See N72-17601 08-22)

(Contract NAS7-100)

Avail: NTIS HC $10.00/MF $0.95 CSCL 10A

A major concern in the integration of a radioisotope thermoelectric generator (RTG) with a spacecraft designed to explore the outer planets is the effect of the emitted radiation on the normal operation of scientific instruments. The necessary techniques and tools developed to allow accurate calculation of the neutron and gamma spectrum emanating from the RTG. The specific sources of radiation were identified and quantified. Monte Carlo techniques are then employed to perform the nuclear transport calculations. The results of these studies are presented. An extensive experimental program was initiated to measure the response of a number of scientific components to the nuclear radiation. Author

N72-17719*# Atomic Weapons Research Establishment, Aldermaston (England).

EVALUATION OF 2 POSSIBLE FURTHER DEVELOPMENTS OF THE UK IN-FLIGHT RADIATION WARNING METER FOR SSTS c14

I. J. Wilson and R. C. Eustace *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 874-883 refs (See N72-17601 08-22)

Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

A mass reduction of the moderator and the response to the nucleon flux, responsible for the tissue-star component of the total-dose equivalent rate using a high atomic number material, are discussed. Radiation situations at SST cruising altitudes (approximately 20 km) due to solar proton flares were simulated in the stratosphere and on the ground. Actual stratospheric situations due to galactic cosmic radiation with a limited range of quality factor values (2-4) were encountered during slow ascents by balloons to 36 km. Synthetic situations obtained from high and low energy acclerator radiations were used to obtain radiation distributions having a larger range of quality factor values (11/2-9) than experienced in the stratosphere. The measurements made in these simulations related to the directly ionizing, neutron and tissue-star components of dose-equivalent rate. Due to the restricted range of neutron spectra encountered in the stratosphere, a significant mass reduction of the moderator by 4 kg was made, with the moderator clad with cadmium or some other slow neutron absorber. Author

N72-17720*# California Univ., Berkeley. Lawrence Radiation Lab.

AN EXPERIMENTAL MEASUREMENT OF GALACTIC COSMIC RADIATION DOSE IN CONVENTIONAL AIRCRAFT BETWEEN SAN FRANCISCO AND LONDON COMPARED TO THEORETICAL VALUES FOR CONVENTIONAL AND SUPERSONIC AIRCRAFT c29

Roger Wallace and Michael F. Boyer *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 884-893 refs (See N72-17601 08-22)

Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

These direct measurements are in fair agreement with computations made using a program which considers both basic cosmic ray atmospheric physics and the focusing effect of the earth's magnetic field. These measurements also agree with those made at supersonic jet aircraft altitudes in Rb-57 aircraft. It is concluded that experiments and theory show that the doses received at conventional jet aircraft altitudes are slightly higher than those encountered in supersonic flights at much higher altitudes. Author

N72-17721*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

RADIATION MEASUREMENTS AND DOSES AT SST ALTITUDES c13

Trutz Foelsche *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 894-901 refs (See N72-17601 08-22)

Avail: NTIS HC $10.00/MF $0.95 CSCL 04A

Radiation components and dose equivalents due to galactic and solar cosmic rays in the high atmosphere, especially at SST altitudes, are presented. The dose equivalent rate for the flight personnel flying 500 hours per year in cruise altitudes of 60,000-65,000 feet (18-19.5 km) in high magnetic latitudes is about 0.75-1.0 rem per year averaged over the solar cycle, or about 15-20 percent of the maximum permissible dose rate. Author

N72-17722*# Air Force Weapons Lab., Kirtland AFB, N.Mex.

DOSE AND LINEAR ENERGY TRANSFER SPECTRAL MEASUREMENTS FOR THE SUPERSONIC TRANSPORT PROGRAM c14

Richard B. Philbrick *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 902-907 refs (See N72-17601 08-22)

Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

The purpose of the package, called the high altitude radiation instrumentation system (HARIS), is to measure the radiation hazard to supersonic transport passengers from solar and galactic cosmic rays. The HARIS includes gaseous linear energy transfer spectrometer, a tissue equivalent ionization chamber, and a geiger meuller tube. The HARIS is flown on RB-57F aircraft at 60,000 feet. Data from the HARIS are reduced to give rad and rem dose rates measured by the package during the flights. Results presented include ambient data obtained on background flights, altitude comparison data, and solar flare data. Author

N72-17723*# Atomic Energy Commission, New York. Health and Safety Lab.

EXPERIMENTAL DETERMINATION OF COSMIC RAY CHARGED PARTICLE INTENSITY PROFILES IN THE ATMOSPHERE c29

W. M. Lowder, P. D. Zraft, and H. L. Beck *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 908-913 refs (See N72-17601 08-22)

Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

Absolute cosmic-ray free air ionization and charged particle fluxes and dose rates throughout the atmosphere were measured on a series of balloon flights that commenced in 1968. Argon-filled ionization chambers equipped with solid-state electrometers, with different gas pressures and steel wall thicknesses, and a pair of aluminum-wall Gm counters have provided the basic data. These data are supplemented by measurements with air-filled and tissue equivalent ionization chambers and a scintillation spectrometer. Laboratory experiments together with analyses of the theoretical aspects of the detector responses to cosmic radiation indicate that these profiles can be determined to an overall accuracy of + or - 5 percent. Author

N72-17724*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SOME GAMMA-RAY SHIELDING MEASUREMENTS MADE AT ALTITUDES GREATER THAN 115000 FEET USING LARGE Ge(Li) DETECTORS c29

G. T. Chapman (ORNL, Oak Ridge, Tenn.), R. P. Cumby (ORNL, Oak Ridge, Tenn.), J. H. Gibbons (ORNL, Oak Ridge, Tenn.), R. L. Macklin (ORNL, Oak Ridge, Tenn.), and H. W. Parker *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 914-921 refs (See N72-17601 08-22)

Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

A series of balloon-flight experiments at altitudes greater than 115,000 feet were conducted to gain information relative to the use of composite shields (passive and/or active) for shielding large-volume, lithium-drifted, germanium (Ge(Li)) detectors used in gamma-ray spectrometers. Data showing the pulse-height spectra of the environmental gamma radiation as

measured at 5.3 and 3.8 gms sq cm residual atmosphere with an unshielded diode detector are also presented. Author

N72-17725*# Oak Ridge National Lab., Tenn.
NEUTRON SPECTRAL MEASUREMENTS IN THE UPPER ATMOSPHERE c13
W. Zobel, T. A. Love, J. T. Delorenzo, and C. O. McNew *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 922-925 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 04A

An experiment to measure neutrons in the upper atmosphere was performed on a balloon flight from Palestine, Texas, at an altitude of about 32 km. The experimental arrangement is discussed briefly, and results of a preliminary analysis of the data for neutrons in the energy range 3 to 30 MeV are given. Author

N72-17726*# Atomic Energy Commission, New York. Health and Safety Lab.
THE PHYSICAL THEORY OF ONE DIMENSIONAL GALACTIC COSMIC-RAY PROPAGATION IN THE ATMOSPHERE c29
Keran OBrien *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 926-941 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

An analytical theory of atmospheric cosmic-ray propagation is developed based on a phenomenological model of hadron-nucleus collisions. This model correctly predicts the sea level cosmic-ray nucleon, pion and muon spectra, the cosmic-ray ionization profile in the atmosphere, and neutron flux and density profiles in the atmosphere. It is concluded that the large scale properties of atmospheric cosmic-rays can be accurately predicted on the basis of a nucleonic cascade with all secondaries mediated by pion production. Implications for energy independence of cross sections, the recent 70 GeV results from Serpukhov, and nucleonic relaxation rates in the atmosphere are discussed.
Author

N72-17727*# Air Force Academy, Colo.
ADVANCED DOSIMETRY SYSTEMS FOR THE SPACE TRANSPORT AND SPACE STATION c14
Louis F. Wailly, Marion F. Schneider (AFWL), and Benton C. Clark (Martin Marietta Corp.) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 944-957 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

Advanced dosimetry system concepts are described that will provide automated and instantaneous measurement of dose and particle spectra. Systems are proposed for measuring dose rate from cosmic radiation background to greater than 3600 rads/hr. Charged particle spectrometers, both internal and external to the spacecraft, are described for determining mixed field energy spectra and particle fluxes for both real time onboard and ground-based computer evaluation of the radiation hazard. Automated passive dosimetry systems consisting of thermoluminescent dosimeters and activation techniques are proposed for recording the dose levels for twelve or more crew members. This system will allow automatic onboard readout and data storage of the accumulated dose and can be transmitted to ground after readout or data records recovered with each crew rotation.
Author

N72-17728*# Air Force Weapons Lab., Kirtland AFB, N.Mex. Technology Div.
EXPERIMENTAL ACTIVE AND PASSIVE DOSIMETRY SYSTEMS FOR THE NASA SKYLAB PROGRAM c14
Marion F. Schneider, Joseph F. Janni, and Glenn C. Ainsworth *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 958-973 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 14B

Active and passive dosimetry instrumentation to measure absorbed dose, charged particle spectra, and linear energy transfer spectra inside the command module and orbital workshop on the Skylab program were developed and tested. The active dosimetry system consists of one integral unit employing both a tissue equivalent ionization chamber and silicon solid state detectors. The instrument measures dose rates from 0.2 millirad/hour to 25 rads/hour, linear energy transfer spectra from 2.8 to 42.4 Kev/micron, and the proton and alpha particle energy spectra from 0.5 to 75 Mev. The active dosimeter is equipped with a portable radiation sensor for use in astronaut on-body and spacecraft shielding surveys during passage of the Skylab through significant space radiations. Data are transmitted in real time or are recorded by onboard spacecraft tape recorder for rapid evaluation of the radiation levels. The passive dosimetry systems consist of twelve (12) hard-mounted assemblies, each containing a variety of passive radiation sensors which are recoverable at the end of the mission for analysis.
Author

N72-17729*# Oak Ridge Associated Universities, Tenn.
DOSIMETRY FOR RADIOBIOLOGICAL STUDIES OF THE HUMAN HEMATOPOIETIC SYSTEM c04
W. L. Beck, T. R. Stokes, and C. C. Lushbaugh *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 974-981 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

A system for estimating individual bone marrow doses in therapeutic radiation exposures of leukemia patients was studied. These measurements are used to make dose response correlations and to study the effect of dose protraction on peripheral blood cell levels. Three irradiators designed to produce a uniform field of high energy gamma radiation for total body exposures of large animals and man are also used for radiobiological studies.
Author

N72-17730*# Case Western Reserve Univ., Cleveland, Ohio.
HAIR RADIOACTIVITY AS A MEASURE OF EXPOSURE TO RADIOISOTOPES c04
W. H. Strain (Cleveland Metro. Gen. Hosp.), W. J. Pories (Cleveland Metro. Gen. Hosp.), R. B. Fratianne (Cleveland Metro. Gen Hosp.)04(Cleveland Metro. Gen. Hosp.), and A. Flynn *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 982-999 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 06R

Since many radioisotopes accumulate in hair, this tropism was investigated by comparing the radioactivity of shaved with plucked hair collected from rats at various time intervals up to 24 hrs after intravenous injection of the ecologically important radioisotopes, iodine-131, manganese-54, strontium-85, and zinc-65. The plucked hair includes the hair follicles where biochemical transformations are taking place. The data indicate a slight surge of each radioisotpe into the hair immediately after injection, a variation of content of each radionuclide in the hair, and a greater accumulation of radioactivity in plucked than in shaved hair. These results have application not only to hair as a measure of exposure to radioisotopes, but also to tissue damage and repair at the hair follicle. Author

N72-17731*# National Aeronautics and Space Administration. Manned Spacecraft Center, Langley Station, Va.
OBSERVATIONS OF COSMIC RAY INDUCED PHOSPHENES c29
P. K. Chapman, L. S. Pinsky, R. E. Benson, and T. F. Budinger (Calif. Univ., Berkeley) *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 1002-1006 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

Phosphene observations by astronauts on flights near and far from earth atmosphere are discussed. It was concluded that phosphenes could be observed by the naked eye. Further

investigation is proposed to determine realistic human tolerance levels for extended missions and to evaluate the need to provide special spacecraft shielding. J.A.M.

N72-17732*# California Univ., Berkeley. Lawrence Radiation Lab.
THE HEAVY PARTICLE HAZARD, WHAT PHYSICAL DATA ARE NEEDED? c04
S. B. Curtis and M. C. Wilkinson (Boeing Co., Seattle) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 1008-1015 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

The physical data required to evaluate the radiation hazard from heavy galactic cosmic rays to astronauts on extended missions are discussed. The spectral characteristics, nuclear interaction parameters, and track structure of particles are emphasized. The data on the lower energy portion of the differential spectrum of the iron group and nuclear fragmentation in tissue and aluminum are tested, and results are shown. J.A.M.

N72-17733*# Los Alamos Scientific Lab., N.Mex.
VENTING OF FISSION PRODUCTS AND SHIELDING IN THERMIONIC NUCLEAR REACTOR SYSTEMS
E. W. Salmi *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 1016-1020 ref (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 18F

Most thermionic reactors are designed to allow the fission gases to escape out of the emitter. A scheme to allow the fission gases to escape is proposed. Because of the low activity of the fission products, this method should pose no radiation hazards. Author

N72-17734*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMIZED 4 pi SPHERICAL SHELL DEPLETED URANIUM-WATER SHIELD WEIGHTS FOR 200 TO 550-MEGAWATT REACTORS
Millard L. Wohl, Jack Celnik (Gulf United Nucl. Fuels Corp., Elmsford, N. Y.), and Robert D. Schamberger (Gulf United Nucl. Fuels Corp., Elmsford, N. Y.) Washington Feb. 1972 13 p refs
(NASA-TM-X-2503; E-6664) Avail: NTIS CSCL 18I

Optimization calculations to determine minimum 4 pi spherical-shell weights were performed at 200-, 375-, and 550-megawatt-thermal reactor power levels. Monte Carlo analyses were performed for a reactor power level corresponding to 375 megawatts. Power densities for the spherical reactor model used varied from 64.2 to 256 watts per cubic centimeter. The dose rate constraint in the optimization calculations was 0.25 mrem per hour at 9.14 meters from the reactor center. The resulting shield weights were correlated with the reactor power levels and power densities by a regression analysis. The optimum shield weight for a 375-megawatt, 160-watt-per-cubic-centimeter reactor was 202,000 kilograms. Author

N72-17735# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
MATERIALS RESEARCH IN ATOMIC ENERGY OF CANADA LIMITED
1971 21 p refs
(AECL-3992; DR-1942) Avail: AEC Depository Libraries

Effects of short circuiting paths on diffusion are discussed, in terms of dislocations and grain boundaries. A thermodynamic and kinetic model of delayed failure is outlined. Mechanical testing of fuel cladding, stress relaxation experiments, plastic instability in zirconium alloy fuel cladding and pressure tubes, and swelling in irradiated U3Si are also reviewed. J.A.M.

N72-17736# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
SYNOPSIS OF THE ACTIVITIES OF THE JOINT RESEARCH CENTRE OF THE COMMISSION OF THE EUROPEAN COMMUNITIES
P. Caprioglio and H. W. Schleicher May 1971 14 p Presented at 4th Intern. Conf. on The Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6 Sep. 1971
(A/Conf-49/P-724; Conf-710901-322) Avail: AEC Depository Libraries

The activities of the Ispra establishment in the field of nuclear reactors are mainly related to research on materials, reactor physics and safety problems. The activities of the Petten establishment are focused on problems emerging from the preparation and the development of pyrocarbons, as well as on the properties of graphite and refractory compounds under irradiation. These studies are related to the development of high temperature gas cooled reactors. The studies carried out at the European Transuranium Institute (Karisruhe) on the fuel for fast reactors represent a basic program meant to clarify the phenomena which affect fuel materials containing plutonium under irradiation. The Central Bureau of Nuclear Measurements (Geel) is essentially dealing with high-precision measurements of neutron cross-sections at various energies as well as precision measurements of radioactivity, fissile constants and neutron dosimetry. Author (NSA)

N72-17737# Oak Ridge National Lab., Tenn.
ROD : A NUCLEAR AND FUEL CYCLE ANALYSIS CODE FOR CIRCULATING FUEL REACTORS
H. F. Bauman, G. W. Cunningham, III, J. L. Lucius, H. T. Kerr, and C. W. Craven, Jr. Sep. 1971 244 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3359) Avail: NTIS

ROD (reactor optimum design) is a computer code for simultaneously optimizing the core design and performing the fuel-cycle analysis for circulating-fuel reactors. It consists of a multigroup diffusion calculation, including multiple thermal groups with neutron upscatter, in one-dimension or in two-dimensional synthesis, combined with an equilibrium fuel-cycle calculation. Cross sections in the CITATION format are required. The equilibrium calculation is a fuel cycle model, including the effects of processing and of nuclear transmutation and decay. Fuel-cycle costs and fission-product concentrations are calculated, the fission products by an independent calculation from internally stored two-group cross sections. Special features of ROD are an optimization routine based on the gradient-projection method, a flux-plotting option, and a subprogram for simple time-dependent calculations based on reaction rates from the main program. Author (NSA)

N72-17738# General Electric Co., San Jose, Calif. Breeder Reactor Dept.
PERFORMANCE TESTS OF SODIUM FILLED POWDER AND PELLET OXIDE FUEL UNDER TRANSIENT OVER-POWER
T. Hikido and J. H. Field Jul. 1971 56 p refs
(Contract AT(04-3)-189)
(GEAP-13722) Avail: NTIS

The performance of sodium-filled fuel pins in power transients was investigated using two experimental capsules in the TREAT (transient) facility. Each capsule contained three slightly enriched 0.250-inch o.d., stainless steel clad UO2 fuel specimens. The three specimens (reference gas-bonded pellet, sodium-filled pellet, and sodium-filled powder), arranged side by side, were compared with respect to fuel temperatures, mechanical deformations, and post irradiation appearance. There were no failures even though over fifty area percent of the gas-bonded pellet fuel specimen melted. The increased heat transfer afforded by the sodium resulted in significantly lower fuel temperatures in those two fuel pins. Author (NSA)

N72-17739# Oak Ridge National Lab., Tenn.
FAST REACTOR SHIELDING, ACTIVITY NO. 40 01 61, 189A NO. 10028 Monthly Progress Report, Aug. 1971
F. R. Mynatt, C. E. Clifford, M. L. Gritzner, R. E. Maerker, and B. J. McGregor 17 Sep. 1971 34 p
(Contract W-7405-eng-26)
(ORNL-TM-3573) Avail: NTIS

A discrete ordinates analysis is used to evaluate reactor shielding for a core support grid plate, a bottom grid plate, and a neutron flux monitor guide tube, as well as the effects of thermal neutron emission and stored fuel on neutron flux in core vessel shielding. Benchmark measurements on shielding effects of sodium coolant in a liquid metal fast breeder reactor are outlined. Author (NSA)

N72-17740# International Atomic Energy Agency, Vienna (Austria).
DETERMINATION OF ABSORBED DOSE IN REACTORS
1971 261 p refs
(STI/Doc-10/127) Avail: NTIS; IAEA $7.00

The requirements for absorbed dose determination in low atomic number materials in reactor cores are discussed. The materials include graphite, water, carbon dioxide, and hydrocarbons. Reactor radiation, reactor dosimetry problems, radiation spectra, and the calculation of absorbed dose are described. Experimental methods for the measurement of absorbed dose in reactors, including calorimetry, ionization chambers, and chemical and solid state dosimetry, are surveyed. 361 references. NSA

N72-17741# Oak Ridge National Lab., Tenn.
ORNL ISOTOPIC POWER FUELS Quarterly Report, period ending 30 Jun. 1971
Eugene Lamb Sep. 1971 32 p refs
(Contract W-7405-eng-26)
(ORNL-4723) Avail: NTIS

Procedures were developed with stand-in materials for fabricating cermets of varying fuel fractions which are permeable to helium and of high strength. These cermets are blends of metal and ceramic powders and can be produced by either hot-pressing or cold-pressing followed by sintering. Gadolinium is the stand-in for curium in the initial phase of process development for sized particles to be used in forming curium cermets. Rexyn 102H and Stratobed-84 ion exchange resins are being used in the study. Variables affecting density are being investigated to aid in obtaining a consistent high density. The most dense product was produced by loading the Gd2O3 onto Rexyn 102H. ORNL will fabricate the fuel pellets to be used in an accelerated (Pu-238)O2 fuel aging study. All parts of the CVD apparatus were fabricated and are being tested. Experiments are being performed to determine phases present in Cm2O3-PuO2 mixtures with Cm/Pu ratios of 0.03, 0.06, and 0.10. Author (NSA)

N72-17742# Western Environmental Research Lab., Las Vegas, Nev.
OFF-SITE SURVEILLANCE FOR THE NRX-A6 REACTOR TEST SERIES
Aug. 1971 46 p refs Sponsored by AEC
(SWRHL-78-r) Avail: NTIS

The NRX-A6 reactor test was a 60 minute full-power test under the NERVA program. The off-site radiological monitoring procedures used and the data obtained are summarized. NSA

N72-17743# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
SAVANNAH RIVER LABORATORY Co60 POWER AND HEAT SOURCES
C. L. Angerman Aug. 1971 19 p refs
(Contract AT(07-2)-1)
(DP-1279) Avail: NTIS

Satisfactory performance through 20,000 hr at 900 C was demonstrated with an Inconel 600 capsule containing unirradiated cobalt metal. Superalloys reacted slightly more with soil than with air during exposures at 1000 and 1093 C for one year. Satisfactory performance through 1000 hr at 1200 C was demonstrated with a tungsten capsule containing unirradiated cobalt metal. Results of additional oxidation tests of Nickel 200, which is similar to the Nickel 201 that is being used as the core material in the WANL 30 kW(t) Unit, indicate a slower oxidation rate than predicted from previous tests. A thermoelectric generator fueled with Co77-60 continued to operate satisfactorily with an electrical output of watts. Author (NSA)

N72-17744# McDonnell-Douglas Astronautics Co., Richland, Wash. Donald W. Douglas Labs.
PLUTONIA/CURIA COMPATIBILITY TESTING Quarterly Report, Apr. - Jun. 1971
R. L. Andelin and J. D. Watrous Jul. 1971 41 p
(Contract AT(45-1)-2138)
(MDC-3124; QR-11) Avail: NTIS

Attack mechanisms by plutonia-molybdenum cermets on refractory alloy double containers appear to be explainable on the basis of results of prior plutonia/monometallic refractory alloy tests. Specimens have been examined after 1500 C 500-hour, 1800 C 1000-hour, and 2000 C 1000-hour exposures. Evidence of significant deterioration in plutonia-molybdenum cermet has been shown for specimens exposed at 1800 and 2000 C for 5000 and 10,000 hours. Curia-244 appears to attack tungsten intergranularly, molybdenum by solution, and W-25Re, Re, Mo-46Re, and W-30Mo-30Re by minor precipitation/void formation after exposure at 2000 C for 1000 hours. Author (NSA)

N72-17745# Mound Lab., Miamisburg, Ohio.
METALLOGRAPHIC INVESTIGATION OF TWO LARGE RADIOISOTOPIC HEAT SOURCE (LRHS) CAPSULES
J. E. Selle and K. L. Breakall 29 Sep. 1971 43 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1853) Avail: NTIS

Two unvented, 200-W large radioisotopic heat source (LRHS) capsules were removed from shelf tests in July 1970 for a complete metallographic analysis. One capsule was fueled with plasma-fired microspheres and the other capsule was fueled with a PuO2 microsphere-molybdenum cermet. Examination of the capsules showed that 81.3% of the helium was released by the fuel; some swelling of the cermet fuel had taken place; and the T-111 strength member of the microsphere-fueled capsule was found to be cracked upon removal from the clad. Furthermore, the Ta-10% W liner in the microsphere-fueled capsule had not only undergone considerable grain boundary oxidation but had also reacted with the impurities present in the fuel. The Ta-10% W liner and T-111 strength member from the Mo-cermet fueled capsule were not embrittled. Author (NSA)

N72-17746# Los Alamos Scientific Lab., N.Mex.
NUCLEAR SAFETY OF AN AIRBORNE THERMAL REACTOR. THE REACTOR CRITICALITY ANALYSIS PROGRAM Status Report, 1 Oct. 1971
J. C. Vigil, B. M. Carmichael, and G. H. Best 1 Oct. 1971 11 p refs
(Contract W-7405-eng-36)
(LA-4783) Avail: NTIS

Neutronic calculations were performed to investigate the feasibility of using a diluent poison to solve the criticality problem arising from core meltdown for the airborne thermal reactor concept. Survey calculations were performed in one-dimensional spherical geometry on both bare and reflected spheres containing diluent:UO2 core volume ratios of 0.0, 0.5, 1.0, 2.0, and 3.0. The diluents studied were W, WB, WB2, Ta, TaB2, and Re. With the exception of W, the calculations indicate that any of these diluents could be used to solve the criticality problem with diluent:UO2 volume ratios of 1.7 or less. For W, a volume ratio of 3.0 is required. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N72-17747* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
METHOD OF DETECTING IMPENDING SATURATION OF MAGNETIC CORES Patent
Ramon A. Cacossa, inventor (to NASA) Issued 5 Oct. 1971 7 p Filed 15 Jan. 1969
(NASA-Case-ERC-10089; US-Patent-3,611,330; US-Patent-Appl-SN-791267; US-Patent-Class-340-174CT; US-Patent-Class-340-174AG; US-Patent-Class-340-174GA; US-Patent-Class-340-174SC) Avail: US Patent Office CSCL 20C

An apparatus is described for detecting impending saturation in magnetic cores. A saturable core, which may be toroidally formed, has an aperture in the circumference of the toroid. Windings are separately wound around the toroid between the aperture and the outer edge of the toroid and between the aperture and the inner edge of the toroid. The windings are serially connected in voltage-opposing relation. When saturation of the core starts to occur in one direction or the other, a voltage unbalance in the windings occurs. This unbalance causes a signal to occur which is detectable and indicates the start of saturation. Official Gazette of the U.S. Patent Office

N72-17748*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAGNETISM, DIMENSIONAL CHANGES, AND MAGNETIC TRANSITIONS IN HYDRATED CESIUM MANGANESE CHLORIDE
John A. Woollam and Paul R. Aron Washington Feb. 1972 22 p refs
(NASA-TN-D-6652; E-6240) Avail: NTIS CSCL 20C

Dimensional changes (strain) along the three principal crystal axes of the antiferromagnet $CsMnCl3\text{-}2H2O$ are studied as a function of magnetic field and temperature in the antiferromagnetic, spin flopped, and paramagnetic phases. Changes in dimensions through the phase transitions between the magnetic states are examined. By applying the molecular field model and utilizing all available information, magnetic properties of $CsMnCl3\text{-}2H2O$ are determined. The possible usefulness of this material in a magnetic refrigeration cycle is evaluated. Author

N72-17749# Oak Ridge National Lab., Tenn.
MAGNETIC FORM FACTOR FOR METALLIC GADOLINIUM
H. L. Davis and J. F. Cooke Oct. 1971 6 p refs Presented at the Conf. on Magnetism, Chicago, 16-19 Nov. 1971
(Contract W-7405-eng-26)
(Conf-711108-1) Avail: NTIS

Magnetic form factor calculations were performed using 4f wave functions obtained from relativistic Hartree-Fock-Slater calculations for free and Wigner-Seitz gadolinium atoms and ions. Only small differences exist between the results for free Gd(0) and free Gd(3+), and between free-atom and Wigner-Seitz results for Gd(0). However, significant changes were observed as the amount of exchange varied in the Hartree-Fock-Slater calculation. Comparing the results with previous calculations and recent experiments led to the conclusion that conduction electron screening produces only minor effects on the form factor, with the major difference between experiment and previous calculation probably being due to indirect relativistic screening. Author (NSA)

N72-17750# Brookhaven National Lab., Upton, N.Y.
COMPARISON OF HIGH-FIELD BENDING MAGNETS BASED ON THE SEXTUPOLE CORRECTIONS REQUIRED
G. Parzen and K. Jellett 7 Sep. 1971 7 p refs Sponsored by AEC
(BNL-16186; AADD-182; CRISP-71-34) Avail: NTIS

A comparison is made of three bending magnets, based on the requirements of the sextupole correction coil. The three magnets considered are the cosine magnet, the H-magnet, and the window-frame magnet. A comparison is made of the stored energy associated with the sextupole correction coil and the current required by the sextupole coil. The results of the comparison particularly favor the cosine magnet. Author (NSA)

N72-17751# Texas Univ., Austin. Center for Particle Theory.
MAGNETIC QUARKS AND ELECTRIC QUARKS IN HADRONS
Chen-Kun Chang 23 Jul. 1971 44 p refs Sponsored in part by NSF and AEC
(ORO-3992-63; CPT-113; AEC-63) Avail: NTIS

Dirac's magnetic monopoles are generalized to have aspects which are similar to the conventional quarks (electric quarks). Such magnetic monopoles are called magnetic quarks. It is assumed that a baryon consists of three solid bodies called electromagnetic quarks, and that an electromagnetic quark and an anti-electromagnetic quark form a meson. New baryon mass relations and magnetic moments are derived. Finally, a strong electric dipole moment is predicted to exist in a baryon state with nonzero electromagnetic quark-orbital angular momentum. Author (NSA)

N72-17752# Brookhaven National Lab., Upton, N.Y. Accelerator Dept.
PROPOSED TOLERANCE ON MAGNETIC FIELD NONLINEARITIES IN HIGH ENERGY STORAGE RINGS
G. Parzen 4 Oct. 1971 7 p refs Sponsored by AEC
(BNL-16212; CRISP-71-36; AADD-183) Avail: NTIS

The problem of tolerances on magnetic field nonlinearities in storage rings with long beam lifetimes is considered. The nonlinearities present in the CERN storage rings are reviewed. Possible effects of nonlinearities are discussed. A tentative tolerance is suggested on nonlinearities in the magnetic field. The effects of nonlinearities introduced by random errors in the magnet are also considered. Author (NSA)

N72-17753# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.
TRANSPORT PROPERTIES OF DILUTE MAGNETIC ALLOYS IN MAGNETIC FIELDS
Klaus-Peter Bohnen Apr. 1971 74 p refs In GERMAN
(JUL-750-FF) Avail: AEC Depository Libraries

The scattering of electrons on magnetic defects is theoretically treated. Transport theory, a model, the Boltzmann equation and its solution with one relaxation time, and calculation of relaxation time are discussed. Magnetoresistance in Born's first approximation is subsequently treated. The discussion centers on the scattering of conduction electrons according to the transport equation in a static magnetic field. Results of the theoretical analysis have validity for the combination of either high temperatures and random magnetic fields or for strong magnetic fields and random temperatures because, for the two cases, defect calculations converge. NSA

N72-17754# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
FERROMAGNETIC RESONANCE IN AN AMORPHOUS Co-Pd-Si ALLOY
Ryusuke Hasegawa Oct. 1971 6 p refs
(Contract AT(04-3)-822)
(CALT-822-38; AEC-RD-33) Avail: NTIS

Ferromagnetic resonance measurements have been reported for amorphous Co-Au and Ni metals obtained by vapor-

quenching. The results on an amorphous Co10Pd70Si20 alloy obtained by rapid-quenching from the liquid state are shown. Both electrical and magnetic properties of the Pd-Si base amorphous alloys containing Co have been studied and the magnetic studies show that a Co10Pd70Si20 alloy is ferromagnetic at room temperature. Ferromagnetic resonance measurements at 9.5 GHz were performed on this amorphous alloy at room temperature and the differentiated absorption spectra for the parallel and perpendicular resonances are presented. (Author)

N72-17755# Naval Underwater Ordnance Station, Newport, R.I.

FAST FIELD PROGRAM FOR MULTILAYERED MEDIA

Frederick R. DiNapoli 26 Aug. 1971 43 p refs

(AD-731041; NUSC-4103) Avail: NTIS CSCL 20/1

The field program (FFP) is a technique for applying fast Fourier transform methods to field theory. Interim results are presented for the FFP applied to a multilayer ocean. The water column subdivided into strata within which the velocity of sound is allowed to vary exponentially with depth is assumed. The kernel of the integral expression for the pressure field is given in terms of cylindrical function products, which can be calculated rapidly through recurrence relations. Results of the FFP and normal mode theory are compared for both a shallow and a deep water example at low acoustic frequencies. In the latter case, the influence of the subbottom structure upon propagation predictions is considered. Author

N72-17756# Aerospace Corp., El Segundo, Calif.

SENSITIVITY OF THERMAL SURFACE SOLAR ABSORPTANCE TO PARTICULATE CONTAMINATION, DECEMBER 1969 - DECEMBER 1970 Engineering Science Operations.

Otto Hamberg and Frank D. Tomlinson 30 Jun. 1971 17 p refs

(Contract F04701-70-C-0059)

(AD-732917; TR-0059(6471)-1; SAMSO-TR-71-264) Avail: NTIS CSCL 20/6

The sensitivity of thermal surface solar absorptance to particulate contamination was evaluated. Experiments were conducted using a mirror surface which was incrementally obscured with a limited number of contaminant types and sizes. Aluminum oxide and fly ash particles were selected to bound high and low contaminant reflectance extremes. Size sensitivity was demonstrated by using 3- and 20-micron aluminum oxide particles. Measurements were made of the obscured surface areas and the corresponding changes in reflectance. From these, the related solar absorptance changes were derived analytically. The changes in absorptance indicated high sensitivity to contaminant composition and quantity, low sensitivity to particle size, and linearity with obscured area. Author (GRA)

N72-17757# Michigan Univ., Ann Arbor. Cooley Electronics Lab.

PRELIMINARY REPORT ON THE COOLEY-BIFI EXPERIMENT

R. M. Heitmeyer and P. W. Wood Oct. 1971 68 p refs

(Contract N00014-67-A-0181-0032)

(AD-732783; TR-210; Rept-036040-6-T) Avail: NTIS CSCL 20/1

An underwater acoustic propagation experiment was jointly conducted by NUSC at New London, Connecticut and a team from Cooley Electronics Laboratory at The University of Michigan. A special pseudo-random waveform, complement phase modulating a carrier was transmitted continuously for 58.5 hours. The power and angle of the carrier, the power in the sidebands, and the noise power in the signal bandwidth were recorded continuously during this time. In addition, the total power and the power spectrum in a narrow band about the carrier were recorded as a measure of the forward scattering reverberation. Also, the cross-correlation of the received signal with a stored reference was continuously computed in order to examine the multipath structure and its stability. The report presents a brief description of the experiment and the on-line analysis of the results. Author (GRA)

N72-17758# Bendix Corp., Southfield, Mich. Research Labs.

INVESTIGATION OF STIMULATED TWO-PHOTON EMISSION AND ANTI-STOKES RAMAN SCATTERING FROM METASTABLE DEUTERIUM ATOMS, PART 2 Final Report, 1 Aug. 1970 - 30 Sep. 1971

Peter Braunlich Oct. 1971 12 p refs

(Contract DAHC04-69-C-0030; DA Proj. 200-61102-B-11-B)

(AD-732899; AROD-7891-5-P-Pt-2; Rept-6041-Pt-2) Avail: NTIS CSCL 20/5

In the report the author analyzes two approaches to the problem of generating vacuum-UV light; namely, stimulated two-photon emission or anti-Stokes Raman scattering from metastable He(21S) atoms in a gas discharge and proton-cesium charge exchange laser. With present state-of-the-art techniques, the construction of only the Cs-ion laser (or proton-cesium charge exchange laser) is feasible. Author (GRA)

N72-17759# National Aviation Facilities Experimental Center, Atlantic City, N.J.

EVALUATION OF CRYOGENIC NITROGEN AS A FIRE EXTINGUISHING AGENT FOR AIRCRAFT POWERPLANT INSTALLATIONS Final Report, 1968 - 1971

George Chamberlain and Eugene P. Klueg Nov. 1971 70 p refs

(FAA Proj. 502-301-15(X))

(AD-732622; FAA-NA-71-3; FAA-RD-71-58) Avail: NTIS CSCL 13/12

Testing was conducted to determine the feasibility of using LN2 as an aircraft power plant fire-extinguishing agent and also to determine the characteristics of LN2 when used as an extinguishment. The tests were conducted in a fire test facility using a full-scale aircraft turbojet engine and nacelle for subsonic low altitude flight condition simulation and also in a mockup engine/nacelle facility where nacelle volume and air flow could be varied. All fire tests were conducted using JP-4 jet fuel which was spray released and spark ignited. The effects of an inadvertent discharge on engine components, the effects of a damaged cowling, and the cooling of potential reignition sources are also described. GRA

N72-17760# Human Engineering Labs., Aberdeen Proving Ground, Md.

SMALL ROCKET NOISE: HAZARDS TO HEARING (ADVANCED LAW PROGRAM)

Georges R. Garinther and David C. Hodge May 1971 40 p refs

(AD-732434; HEL-TM-7-71) Avail: NTIS CSCL 20/1

Temporary threshold shifts were determined for single exposures of subjects to impulses produced by the M20A1 and the M72 rocket launchers. These exposures were at levels up to 179 dB without hearing protection, and up to 184 dB with hearing protection. This study indicates that the CHABA impulse noise damage-risk criterion is valid for single impulses having durations of 12 to 34 milliseconds. The firer of the M72 is subjected to 179 dB which is greatly in excess of the exposure criterion; personnel should not be exposed to such conditions without hearing protection. The standard Army issue earplug (V51-R) nominally provides 25 dB attenuation for this type impulse and permits safe exposures up to 184 dB. GRA

N72-17761# SACLANT ASW Research Center, La Spezia (Italy).

THE (sin x)/x INTERPOLATION OF SAMPLED SIGNALS

Jens M. Hovem 1 Jul. 1971 26 p refs

(AD-730997; SACLANTCEN-TR-196) Avail: NTIS CSCL 20/1

A method for (sin x)/x interpolation of sampled signals is described. The method works by transformation to the frequency domain and therefore requires a digital computer with Fast Fourier Transform capability. Examples of how the (sin x)/x

interpolation can be used for signal reconstruction and in connection with beam-steering are presented. The practical implication of this method for (sin x)/x interpolation is that it allows the use of a sampling frequency that is lower and closer to the theoretical minimum than would otherwise be possible. The complexity and cost of the electronic system used for sampling and recording can thereby be reduced. Author (GRA)

N72-17338# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
THE MEASURING OF OPTICAL FREQUENCIES AND THE VELOCITY OF LIGHT
Z. Bay and G. G. Luther *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 63-66 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

N72-17339# National Bureau of Standards, Boulder, Colo. Radio Standards Physics Div.
DEFINING THE SPEED OF LIGHT: A COMBINATION TIME, FREQUENCY, AND LENGTH STANDARD; RECENT PROGRESS TOWARD MEASURING THE FREQUENCY OF VISIBLE LIGHT
K. M. Evenson, J. S. Wells, and L. M. Matarrese *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 67-69 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C13.10:343

N72-17347# Electrotechnical Lab., Tokyo (Japan).
A gamma sub p' DETERMINATION AT THE ETL; TWO PROPOSALS FOR OBTAINING A UNIFORM CALCULABLE MAGNETIC FIELD FOR AN ATOMIC STANDARD OF CURRENT
Ko Hara and Hisao Nakamura *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 123-130 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17348# National Physical Lab., Teddington (England).
THE GYROMAGNETIC RATIO OF THE PROTON MEASURED IN A HIGH MAGNETIC FIELD
B. P. Kibble and G. J. Hunt *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 131-135 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17368# Johns Hopkins Univ., Baltimore, Md.
PROBLEMS IN RELATIVE AND ABSOLUTE MEASUREMENT OF X-RAY WAVELENGTHS
J. A. Bearden *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 251-254 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17369# Johns Hopkins Univ., Baltimore, Md.
RULED GRATING MEASUREMENTS OF THE Al K alpha 1,2 WAVELENGTH
Albert Henins *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 255-258 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17371# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
X-RAY/OPTICAL INTERFEROMETRY AND X-RAY FUNDAMENTAL CONSTANTS MEASUREMENTS
Richard D. Deslattes *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 265-270 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17374# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
OPTICAL INTERFEROMETRY OF THE 220 REPEAT DISTANCE IN A SILICON CRYSTAL
R. D. Deslattes *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 279-289 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17662*# General Dynamics/Fort Worth, Tex.
THERMODYNAMIC AND TRANSPORT PROPERTIES OF FROZEN AND REACTING pH2-oH2 MIXTURES
H. G. Carter and R. E. Bullock *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 476-480 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20L

N72-17571# Israel Program for Scientific Translations, Ltd., Jerusalem.
A QUALITATIVE ANALYSIS OF SATELLITE INFRARED DATA
E. V. Dzyubenko and V. V. Puchkov *In its* Probl. of Satellite Meteorol. 1970 p 58-74 refs (See N72-17562 08-20)
Avail: NTIS

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N72-17762*# Sterling (Walter V.), Inc., Los Altos, Calif.
RADIATION EFFECTS ON ELECTRONIC PARTS Revision A
W. S. Johnson 18 Jun. 1971 159 p refs
(Contract NAS2-4398)
(NASA-CR-114364) Avail: NTIS CSCL 18F

A search of literature concerning the long term effects of nuclear radiation on electronic parts was conducted to determine the effects of radiation fields encountered on deep space missions to parts used in the Pioneer Spacecraft. Topics discussed include: the various types of radiation the spacecraft will encounter, effects of radiation on electronic parts, and estimates of the damage thresholds for transistors and integrated circuits used on the Pioneer Spacecraft. F.O.S.

N72-17763*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CHARGED PARTICLE MOTION IN THE VICINITY OF A NEUTRAL PLANE
David Stern Feb. 1972 30 p
(NASA-TM-X-65821; X-641-72-22) Avail: NTIS CSCL 20H

The motion of a charged particle in a 2-dimensional neutral sheet with linear magnetic field variation is analyzed by Hamiltonian methods. From the basic Hamiltonian formulation, results of Sonnerup are recovered and given intuitive interpretation. The transformed Hamiltonian is used to derive the correct frequency of oscillation and serves as the basis of analytical treatment of perturbed versions of the motion, e.g. with electric field added. For 2-dimensional fields with slightly differing configurations - in particular, with added small field component orthogonal to the sheet, with an X-type null or with a chain of null points - two alternative methods are developed, reducing the problem either to motion in a 2-dimensional potential or to a pair of coupled oscillators. Author

N72-17764# Battelle-Northwest, Richland, Wash.
NUCLEAR TECHNIQUES FOR TRACE ELEMENT AND RADIONUCLIDE MEASUREMENTS IN NATURAL WATERS
R. W. Perkins and L. A. Rancitelli Jul. 1971 32 p refs Presented at the Meeting on Nucl. Methods in Environ. Res., Columbia, Mo.
(Contract AT(45-1)-1830)
(BNWL-SA-3993; CONF-710818-1) Avail: NTIS

Methods for measuring the trace element and radioisotope contents in natural waters and for using these measurements for studying biogeochemical processes in fresh and salt water systems are discussed. NSA

N72-17765# Kansas State Univ., Manhattan. Dept. of Nuclear Engineering.
FAST NEUTRON TRANSMISSION MEASUREMENTS FOR REACTOR CORE AND SHIELDING MATERIALS Final Report
W. Meyer, J. O. Mingle, D. H. Timmons, P. G. Kirmser, K. K. Hu, Thomas R. Hill, and James W. Thiesing 31 Aug. 1971 25 p refs
(Contract AT(11-1)-2049)
(COO-2049-10) Avail: NTIS

Activities in the design and performance of double differential fast neutron transmission experiments for semi-infinite slabs of several reactor core construction and shielding materials including concrete, iron, water and laminated assemblies of these materials of precisely defined structure are reported. These experiments were designed to generate fast neutron penetration data that are necessary to complex core shielding analyses as well as to test and evaluate fast neutron transport codes. Author (NSA)

N72-17766# Oak Ridge National Lab., Tenn.
NEUTRON-CAPTURE-GAMMA RAY SPECTRUM CALCULATIONS FOR MATERIALS FOR POSSIBLE USE IN A Cf-252 NEUTRON ACTIVATION FACILITY
V. A. Decarlo and E. D. Arnold Jul. 1971 31 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3457) Avail: NTIS

By using the ANISN computer program, neutron-capture-gamma ray information was obtained for a number of materials, in a fixed arrangement, for use in a CF-252 neutron activation facility. This information will be useful in the selection of materials to minimize gamma spectral interference. It was determined that a system using a source encapsulated in platinum encased in Zircaloy-2, with bismuth as the primary gamma shielding material, produced the lowest number of capture gamma rays and the highest thermal flux. Author (NSA)

N72-17767# Atomic Energy Commission, New York. Health and Safety Lab.
FALLOUT PROGRAM Quarterly Summary Report, 1 Jun. - 1 Sep. 1971
Edward P. Hardy, Jr. 1 Oct. 1971 254 p refs
(HASL-245) Avail: NTIS

Current data are presented from the HASL Fallout Program, the National Radiation Laboratory in New Zealand, and Radiological Physics Division at Argonne National Laboratory, and the EURATOM Joint Nuclear Research Centre at Ispra, Italy. The initial section consists of data summaries and notes covering the following topics: Sr-90 fallout and precipitation by ten degree latitude bands, the stratospheric inventory of Pu-238, and stratospheric inventories of fission produces. Subsequent sections include tabulations of radionuclide levels in surface air, stratospheric air, fallout, milk, and tap water. Author (NSA)

N72-17768# Atomic Energy Commission, New York. Health and Safety Lab.
FALLOUT PROGRAM, APPENDIX Quarterly Summary Report, 1 Jun. - 1 Sep. 1971
1 Oct. 1971 429 p
(HASL-245-App) Avail: NTIS

Data are tabulated from fallout monitoring programs carried out from June through September 1971. Results are included from: measurements of Sr-89 and Sr-90 deposition at various world land sites and Atlantic Ocean weather stations; the content of Sr-90 in New York City milk; the content of Cs-137 and Sr-90 in New York City drinking water; and the content of various radioisotopes in samples of surface atmosphere obtained in North, South, and Central America. NSA

N72-17769# Nuclear-Chicago Corp., Austin, Tex. Texas Nuclear Div.
STUDY OF PARTICULATE HETEROGENEITY EFFECTS IN RADIOISOTOPE X-RAY SPECTROMETRY
P. F. Berry 3 Jun. 1971 107 p refs
(Contract AT(40-1)-3847)
(ORO-3847-2) Avail: NTIS

Theories of particle size effects on X-ray interaction phenomena are reviewed and model is presented, which provides experimentally consistent formulae for X-ray fluorescence, transmission, and backscattered radiation intensities in granular materials and slurries. The model is applicable to homogeneous and dissimilar size particle mixtures. The applicability of radiometric methods of particle size analysis was investigated for selected matrices. Methods such as dual X-ray fluorescence and transmission, were examined in particular with regard to the mutual influences of particle size, chemical composition, and (slurry) solid content. In mixtures of particles of equal size, size determination independent of chemical composition was shown to be feasible, with appropriate choice of X-ray energies. The practicality of these techniques however is questionable for mixtures of similar sizes of particle. Author

N72-17770# Zentralstelle fuer Atomkernenergie-Dokumentation, Frankfurt am Main (West Germany).
BIBLIOGRAPHIES IN NUCLEAR SCIENCE AND TECHNOLOGY. SECTION 14: ACTIVATION ANALYSIS
W. Bock-Werthmann, H. Niebuhr, and B. Sansoni May 1971 276 p refs In ENGLISH and GERMAN
(AED-C-14-5-Sect-14) Avail: AEC Depository Libraries

Volume 5 of the series AED-C-14 bibliography in the field of activation analysis contains 701 reference entries. Studies are listed under reports, conference papers, periodicals, books, dissertations, patents, or industrial bulletins. Transl. by G.G.

N72-17771# Bhabha Atomic Research Centre, Bombay (India).
APPLICATIONS OF RADIOISOTOPES AND RADIATION SOURCES IN INDUSTRY, RADIATION PROCESSING AND HYDROLOGY: CURRENT STATUS IN INDIA
V. K. Iya, A. C. Eapen, and K. Krishnamurthy May 1971 20 p refs Presented for 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P-539; Conf-710901-235) Avail: AEC Depository Libraries

Cobalt-60 and Ir-192 sources are extensively used in the country for industrial radiography both during construction of new installations and for regular quality control in industry. Radiotracer techniques have also found wide application in the chemical and metallurgical industries for determining process parameters and for providing other valuable information. Many industrial leak detection problems have been resolved by radioisotope techniques. The application of nucleonic gages for the measurement of the thickness of metal sheets, foils and coatings, for level measurement in hoppers and closed vessels, and for the density measurement of slurries and powders is rapidly increasing and these are briefly described. Author (NSA)

N72-17772# Texas Univ., Austin. Plasma Research Lab.
QUASISTATIC ION CYCLOTRON WAVE STUDIES Progress Report
D. G. Swanson 31 Aug. 1971 15 p refs
(Contract AT(40-1)-3871)

(ORO-3871-6) Avail: NTIS

Theoretical progress was made in the study of damping of finite amplitude waves. A technique was developed that is self consistent and leads to an integral equation that was successfully solved by iteration on the CDC 6600 computer. Preliminary results show that the net damping is stronger than the original work indicated, but that there is still a finite amplitude steadystate solution for long times or far from the source. NSA

N72-17773# Kanner (Leo) Associates, Redwood City, Calif.
EXPERIENCES IN THE MONITORING OF AIR CONTAINING RADIOACTIVE AEROSOLS
L. A. Koenig Jun. 1971 13 p refs Transl. into ENGLISH from Atompraxis (Karlsruhe), v. 16, 1970 p 320-324 Prepared for Los Alamos Sci. Lab.
(LA-tr-71-70) Avail: NTIS

Measurements obtained in two incidents are described. In the first incident, water damage resulted in a contamination which spread about two Curies of alpha activity over an area of 800 sq m. In the second incident, leakage from a plutonium-containing fuel rod resulted in a dust-like contamination in a larger space (several thousand sq m). The various procedures for air monitoring and the determination of the ratio of the volume air contamination to the surface contamination are described. NSA

N72-17774# Paris Univ., Orsay (France). Nuclear Physics Inst.
[EXPERIMENTAL AND THEORETICAL NUCLEAR PHYSICS AND RADIO CHEMISTRY] Annual Report
1970 170 p refs In FRENCH
(NP-18872) Avail: NTIS

The following topics are covered: nuclear physics, high energy physics, radiochemistry, and theoretical physics. A list is given of the seminars, publications, communications, and theses. NSA

N72-17775# Fisheries Research Board of Canada, West Vancouver (British Columbia).
RADIOACTIVITY IN THE MARINE ENVIRONMENT
Michael Waldichuk 1971 28 p Sponsored by AEC Prepared in cooperation with NAS-NRC
(WASH-1185) Avail: NTIS

The state of knowledge on injection, dispersal, uptake by the biota, transfer through the food web, effects on the ecosystem, and ultimate disposition of artificial radionuclides in the marine environment are summarized. Topics covered include: sources of radioactivity and their characteristics; oceanic distributions of radionuclides from nuclear explosions; physical processes of water movement and mixing; marine chemistry; marine sediments and radioactivity; accumulation and redistribution of radionuclides by marine organisms; ecological interactions of marine radioactivity; radiation effects; and evaluation of human radiation exposure. NSA

N72-17776# Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium).
DEVELOPMENT AND IMPROVEMENT OF A NEW IN-PILE TECHNIQUE OF NEUTRON SPECTROMETRY BASED ON THE (n,p) COLLISIONS
G. deLeeuw-Gierts and S. DeLeeuw Apr. 1971 28 p refs In FRENCH
(BLG-454) Avail: AEC Depository Libraries

A proton recoil spectrometer for in-core neutron spectrum measurements is described. The spherical or cylindrical proportional counters, routinely used, cover an energy interval from a few keV up to about 1.5 MeV. The spectrometer was conceived to determine the neutron spectrum above this energy limit. Attention was paid to keep the lower validity energy limit sufficiently small to obtain a large energy interval overlapping with the existing spectra. A hydrogeneous target and a silicon surface-barrier detector are the main parts of the spectrometer. A small proportional counter is inserted between the two to eliminate background pulses in the solid state detector, due to gamma radiation or competitive reactions with the silica of the detector. A filling of argon at low pressure completes the spectrometer. After the performance of the spectrometer was tested in the BR1 thermal graphite column a proton recoil spectrum was measured in the fast assembly mounted in BR1. Author (NSA)

N72-17777# Zentralstelle fuer Atomkernenergie-Dokumentation, Frankfurt am Main (West Germany).
BIBLIOGRAPHIES IN NUCLEAR SCEINCE AND TECHNOLOGY. SECTION 21: DOSIMETRY
Klaus Becker, comp. Jun. 1971 147 p refs
(AED-C-21-8-Sect-21) Avail: AEC Depository Libraries

This volume is concerned with chemical, photographic, and solid state dosimetry. Literature up to mid-1970 is included. NSA

N72-17778# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
CALCULATIONS ON THE TRAJECTORY OF ELECTRONS IN AN ADONE MAGNET USED AS A MOMENTUM ANALYZER
G. Vignola 29 Apr. 1971 7 p ref In ITALIAN
(LNF-71/15) Avail: AEC Depository Libraries

Machine magnets are used as momentum analyzers for the electrons which, after an interaction, have lost part of their energy. This problem was examined from the magnetic optical viewpoint. The problem was formulated as an electron with pulse leaves at an angle from the center of the right section at a given distance from the equilibrium orbit. The angle at which the electron will enter a detector placed in the magnet at a given distance from the equilibrium orbit is calculated. The effects of the magnets and the quadrupoles are calculated separately and added. NSA

N72-17779# Los Alamos Scientific Lab., N.Mex.
NUCLEAR SAFEGUARDS RESEARCH AND DEVELOPMENT Program Status Report, May - Aug. 1971
G. Robert Keepin, ed. Aug. 1971 31 p refs
(Contract W-7405-eng-36)
(LA-4794) Avail: NTIS

Research and development progress are reported on neutron interrogation and nondestructive methods for analysis of fissionable materials; radioactive sources for nondestructive assay applications; passive neutron, gamma, and X-ray assay applications; detector and instrumentation development; analytical studies and computational methods; and the mobile nondestructive assay laboratory. NSA

N72-17780# Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium).
EXPERIMENTAL SETUP FOR CARRYING OUT LOW TEMPERATURE ALPHA RADIATION
G. vonHeydon Feb. 1971 26 p refs In GERMAN
(BLG-452) Avail: AEC Depository Libraries

An experimental setup is described in which the production of defects in thin metal foils by irradiation with alpha particles at temperatures down to 2.5 K and their subsequent recovery up to 100 K can be studied by means of electric-resistivity measurements. Following the low-temperature irradiation, it is possible to perform exact measurements of the critical temperature of superconductivity and residual resistivity measurements without warming up the specimens. Author (NSA)

N72-17781# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXISTENCE AND DETECTION OF FIREBALLS
E. I. Daibog and I. L. Rozental 3 Aug. 1971 25 p refs Transl. into ENGLISH from Kosm. Luchi (USSR), no. 2, 1969 p 23-36
(AF Proj. 4152)

(AD-731899; FTD-MT-24-102-71) Avail: NTIS CSCL 20/8

An attempt is made to analyze critically the experimental proofs indicating the existence of fireballs. Some ideas are presented on methods of the search for fireballs understood as resonances with a large mass. It is conceived that the supposed experimental proofs either are supported by two well known characteristics of strong interactions or are in no relation to the evidence of fireballs but can become important for the determining of the properties of fireballs if their existence will be checked by other methods. Author (GRA)

N72-17782# Oak Ridge National Lab., Tenn. Neutron Physics Div.

NUCLEON AND CHARGED-PION ALBEDO SPECTRA IN AN ACCELERATOR CAVE FROM 200-GeV PROTON INTERACTIONS IN IRON

T. A. Gabriel and R. T. Santoro 27 Aug. 1971 41 p refs Submitted for publication

(Contract W-7405-eng-26)

(ORNL-TM-3437) Avail: NTIS

Nucleon and charged-pion albedo flux distributions in an accelerator cave resulting from the interaction of 200-GeV protons were calculated. The spectra are given as a function of secondary-particle energy and of radial position and distance from the point where the beam is dumped into the iron. Comparisons between the omnidirectional and backward flux distributions are presented. Author (NSA)

N72-17783# Ballistic Research Labs., Aberdeen Proving Ground, Md.

SUMMARY AND APPLICATIONS OF CLUSTER ION REACTORS MEASURED AT THE BALLISTIC RESEARCH LABORATORIES

Franklin E. Niles, Joseph M. Heimerl, George E. Keller, and Lawrence J. Puckett Sep. 1971 25 p refs

(DA Proj. 1T0-61102-B-53-A-15)

(AD-732835; BRL-MR-2127) Avail: NTIS CSCL 07/4

Rate constants for room temperature reactions involving atmospheric cluster ions have been measured using two laboratory facilities: A stationary afterglow facility employing photoionization and separate mass analysis for ions and neutrals; and A drift tube facility employing thermionic emission of alkali ions and mass analysis of ions. In the afterglow facility, the sequence of reactions initiated by NO(-) ions reacting in a gaseous mixture of nitric oxide and water vapor and terminated by H2O(-).4H2O has been studied at 296K with each rate constant measured independently. Likewise, the sequence of reactions initiated by NO(-) ions reacting in a gaseous mixture of nitric oxide and ammonia and terminated by NH4(-).3NH3 has been studied at 296K. In the drift tube facility, the clustering of atmospheric gases to the alkali ions Li(-), Na(-), and K(-) has been studied. From laboratory studies of the clustering of atmospheric gases to alkali ions, a map of the minimum values for initial clustering reaction rate constants and equilibrium constants has been drawn. The importance of the formation of a weakly bound cluster ion followed by a switching reaction to form a strongly bound cluster ion to the ion chemistry of the D region has been shown. Author (GRA)

N72-17784# Dow Chemical Co., Golden, Colo. Rocky Flats Div.

NEUTRON RADIOGRAPHY WITH A SEALED TUBE NEUTRON GENERATOR AND GRAPHITE MODERATED SYSTEM

Dennis Vasilik and Richard Murri 30 Jun. 197' 25 p refs

(Contract AT(29-1)-1106)

(RFP-1706) Avail: NTIS

Neutron radiographs of good quality were produced. The graphite moderator is a right-cylinder 76.2 cm in diameter and 76.2 cm high. A thermal neutron flux at the object of 110,000 n/sq cm sec and a cadmium ratio of 3.5 was measured. The collimator ratio was 7.25; the X-ray intensity was 0.50 mR/sec; and the resolution was measured to be 0.025 cm. Experimental techniques for determining fast and thermal neutron fluences are also described. Author (NSA)

N72-17785# Yale Univ., New Haven, Conn. Final Report, 1 Apr. 1964 - 30 Jun. 1970

MAGNETIC RESONANCE ABSORPTION, POLARIZED ELECTRONS

Vernon W. Hughes 11 Nov. 1971 7 p refs

(Contract Nonr-609(53); NR Proj. 014-306)

(AD-733071) Avail: NTIS CSCL 20/10

The research done under the contract between 1964 and 1970 can be divided into three parts: Production of polarized electrons and study of spin dependent effects in atomic processes; Precision measurement of the magnetic moment of Helium-3; and, Experimental tests for mass anisotropy. GRA

N72-17345# National Physical Lab., Teddington (England).

THE GYROMAGNETIC RATIO OF THE PROTON: A SURVEY

P. Vigoureux *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 111-115 (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

N72-17346# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.

APPLICATION OF NUCLEAR RESONANCE TO THE MONITORING OF ELECTRICAL STANDARDS

R. L. Driscoll and P. T. Olsen *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 117-121 refs (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

N72-17351# Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands).

PRECISION DETERMINATION OF ATOMIC MASSES AND THE EINSTEIN MASS-ENERGY RELATION

A. H. Wapstra *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 151-154 refs (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

N72-17353# National Physical Lab., Teddington (England). Quantum Metrology Div.

METHODS OF MEASURING THE MAGNETIC MOMENT OF THE PROTON IN TERMS OF THE NUCLEAR MAGNETON

B. W. Petley *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 159-167 refs (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

N72-17354# Wisconsin State Univ., La Crosse.

MAGNETIC MOMENT OF THE PROTON IN NUCLEAR MAGNETONS

D. O. Fystrom *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 169-172 refs (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

N72-17355# National Physical Lab., Teddington (England). Quantum Metrology Div.

MEASUREMENT OF (mu sub p)/(mu sub n)

B. W. Petley and K. Morris *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 173-175 refs (See N72-17330 08-14)

Avail: SOD $6.00 as C 13.10:343

N72-17356# Zurich Univ. (Switzerland).
A NOVEL TYPE DETERMINATION OF THE MAGNETIC MOMENT OF THE PROTON IN UNITS OF THE NUCLEAR MAGNETON, (mu sub p)/(mu sub n)
H. Gubler, W. Reichart, M. Roush (Maryland Univ.), H. Staub, and F. Zamboni *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 177-180 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17358# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
COMMENTS ON THE SOMMER, THOMAS, AND HIPPLE OMEGATRON MEASUREMENT OF (mu sub p)/(mu sub n)
D. O. Fystrom (Wisconsin State Univ.), B. W. Petley (Natl. Phys. Lab., Teddington, Engl.), and B. N. Taylor *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 187-194 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17370# New Mexico State Univ., Las Cruces.
PRECISION ATOMIC BINDING ENERGIES
A. F. Burr *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 259-263 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17372# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium). Studiecentrum voor Kernenergie.
MEASUREMENT OF THE COMPTON WAVELENGTH OF THE ELECTRON
P. H. M. VanAssche, J. M. VandenCruyce, G. Vandenput, H. A. Baader, H. R. Koch, D. Breitig, and O. W. B. Schult *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 271-273 refs Prepared in cooperation with Louvain Univ., Tech. Hochschule Munchen, and Danish Atomic Energy Comm., Risoe (See N72-17330 08-14)
Avail: $6.00 as C 13.10:343

N72-17373# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
A POSITRON ANNIHILATION EXPERIMENT FOR DETERMINING THE FINE STRUCTURE CONSTANT
William C. Sauder *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 275-278 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17377# Cornell Univ., Ithaca, N.Y. Lab. of Nuclear Studies.
QUANTUM ELECTRODYNAMIC THEORY: ITS RELATION TO PRECISION LOW ENERGY EXPERIMENTS
Stanley J. Brodsky (Stanford Linear Accelerator Center) *In* Precision Meas. and Fundamental Constants Aug. 1971 p 297-307 refs Sponsored in part by AEC and NSF Prepared in cooperation with Stanford Linear Accelerator Center (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17378# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
THEORY OF THE POSITRONIUM HYPERFINE STRUCTURE
Thomas Fulton, David A. Owen, and Wayne W. Repko *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 309-312 refs Sponsored in part by NSF (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17379# Yale Univ., New Haven, Conn. Gibbs Lab.
PRECISION MEASUREMENT OF THE FINE STRUCTURE INTERVAL OF THE GROUND STATE OF POSITRONIUM
E. R. Carlson, V. W. Hughes, and E. D. Theriot, Jr. *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 313-316 refs (See N72-17330 08-14)
(Grant NSF GP-23722)
Avail: SOD $6.00 as C 13.10:343

N72-17380# Harvard Univ., Cambridge, Mass. Dept. of Physics.
FINE AND HYPERFINE STRUCTURES OF ATOMIC HYDROGEN
Norman F. Ramsey *In* NBS Precision Meas. and Fundamental Constants Aug. 1972 p 317-320 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:243

N72-17381# Yale Univ., New Haven, Conn.
PRESSURE SHIFTS OF HYPERFINE FREQUENCIES IN ONE-ELECTRON ATOMS
E. S. Ensberg and C. L. Morgan *In* NBS Precision Meas. and Fundamental Constants Aug. 1972 p 321-325 refs (See N72-17330 08-14)
(Grant AF-AFOSR-0249-67)
Avail: SOD $6.00 as C 13.10:343

N72-17382# Chicago Univ., Ill. Dept. of Physics.
MEASUREMENT OF THE MUON MAGNETIC MOMENT BY DOUBLE RESONANCE IN MUONIUM, AND A NEW VALUE OF ALPHA
A. Magnon, R. DeVoe, P. M. McIntyre, D. Y. Stowell, R. A. Swanson, and V. L. Telegdi *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 327-331 refs (See N72-17330 08-14)
(Grant NSF GP-6035)
Avail: SOD $6.00 as C 13.10:343

N72-17383# Washington Univ., Seattle. Dept. of Physics.
PRECISION MEASUREMENT OF THE MAGNETIC MOMENT OF THE MUON
J. F. Hague, J. E. Rothberg, A. Schenck, D. L. Williams, R. W. Williams, K. K. Young, and K. M. Crowe (Calif. Univ., Berkeley. Lawrence Radiation Lab.) *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 333-336 refs Supported by AEC and NSF (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17384# Princeton-Pennsylvania Accelerator, Princeton, N.J.
MAGNETIC MOMENT OF THE POSITIVE MUON
D. P. Hutchinson, F. L. Larsen, N. C. Schoen, D. I. Sober, and A. S. Kanofsky *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 337-338 refs (See N72-17330 08-14)
(Contract AT(30-1)-3217)
Avail: SOD $6.00 as C 13.10:343

N72-17385# Yale Univ., New Haven, Conn. Gibbs Lab.
HYPERFINE STRUCTURE INTERVAL OF THE GROUND STATE OF MUONIUM
P. A. Thompson, D. Casperson, P. Crane, T. Crane, P. Egan, V. W. Hughes, G. zuPutlitz (Heidelburg Univ.), and R. Stambaugh *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 339-343 refs (See N72-17330 08-14)
(Contract F44620-71-C-0042)
Avail: SOD $6.00 as C 13.10:343

N72-17386# Brown Univ., Providence, R.I.
DETERMINATION OF THE ATOMIC HYDROGEN FINE STRUCTURE BY LEVEL CROSSING IN THE 2P STATES OF HYDROGEN: A MEASUREMENT OF THE FINE

STRUCTURE CONSTANT
J. C. Baird, John Brandenberger (Lawrence Univ., Appleton, Wis.), Ken-Ichiro Gondaira (Univ. of Electrocommun., Tokyo), and Harold Metcalf (State Univ. of N. Y., Stony Brook) *In* NBS Precision Meas. and Fundamental Constants Aug. 1972 p 345-353 refs (See N72-17330 08-14)
(Grants NSF GP-14104; PRF-3205-A5)
Avail: SOD $6.00 as C 13.10:343

N72-17387# Michigan Univ., Ann Arbor. Randall Lab. of Physics.
A MEASUREMENT OF THE 2 2S1/2-2 2P3/2 ENERGY SEPARATION, (DEL E-S), IN HYDROGEN (n EQUALS 2)
Shynl Tong Wha, R. T. Robiscoe, and W. L. Williams *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 355-360 refs Supported by AEC (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17388# Yale Univ., New Haven, Conn.
A MEASUREMENT OF DEL E-S IN H AND A CORRECTION TO THE MEASURED VALUE OF S IN D
T. V. Vorburger and B. L. Cosens *In* NBS Precision Meas. and Fundamental Constants Aug. 1972 p 361-365 refs Supported by NSF (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17389# Yale Univ., New Haven, Conn.
MEASUREMENT OF THE 2 2S1/2-2 2P3/2 INTERNAL IN ATOMIC HYDROGEN
S. L. Kaufman, W. E. Lamb, Jr., K. R. Lea, and M. Leventhal *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 367-371 refs Supported in part by AFOSR (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17390# Montana State Univ., Bozeman. Dept. of Physics.
ATOMIC BEAMS MEASUREMENTS OF THE FINE STRUCTURE OF H, n EQUALS 2
R. T. Robiscoe *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 373-376 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17391# Harvard Univ., Cambridge, Mass. Lyman Lab.
SEPARATED OSCILLATORY FIELD MEASUREMENT OF THE LAMB SHIFT
C. W. Fabjan and F. M. Pipkin *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 377-381 refs Sponsored in part by the Milton Fund (See N72-17330 08-14)
(Grants NSF GP-8551; NSF GP-22787)
Avail: SOD $6.00 as C 13.10:343

N72-17392# Harvard Univ., Cambridge, Mass. Lyman Lab.
MEASUREMENT OF THE LAMB SHIFT IN THE n EQUALS 4 STATE OF HYDROGEN
R. A. Brown and F. M. Pipkin *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 383-388 refs (See N72-17330 08-14)
(Grants NSF GP-8551; NSF GP-22787)
Avail: SOD $6.00 as C 13.10:343

N72-17393# Yale Univ., New Haven, Conn. Dept. of Physics.
DETERMINATION OF THE FINE STRUCTURE CONSTANT ALPHA FROM HELIUM FINE STRUCTURE
A. Kponou, V. W. Hughes (Calif. Univ., Berkeley), C. E. Johnson (Calif. Univ., Davis), S. A. Lewis (Mass. Univ.), and F. M. J. Pichanick *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 389-391 refs (See N72-17330 08-14)
(Contract F44620-71-C-0042)
Avail: SOD $6.00 as C 13.10:343

N72-17394# National Bureau of Standards, Boulder, Colo.
PRECISION MEASUREMENT OF THE LAMB SHIFT IN SINGLY IONIZED HELIUM
Musti A. Narasimham (Colo. Univ., Boulder) and R. L. Strombotne *In its* Precision Meas. and Fundamental Constants Aug. 1971 p 393-402 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17395*# Columbia Univ., New York. Dept. of Physics.
PRECISION MEASUREMENTS OF THE FINE STRUCTURE AND LIFETIMES OF THE (1s2s2p) 4P SUB J STATES OF He(MINUS) AND Li RESONANCE
Robert Novick and David Weinflash *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 403-410 refs (See N72-17330 08-14)
(Grants NGL-33-008-009; NSF GP-13749)
(NASA-CR-125577) Avail: NTIS; SOD $6.00 as C 13.10:343 CSCL 20H

N72-17396# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
THE PROTON MOMENT IN BOHR MAGNETONS, AND ALL THAT
Daniel Kleppner *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 411-416 refs Sponsored in part by ONR (See N72-17330 08-14)
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N72-17397# Wake Forest Coll., Winston-Salem, N.C. Dept. of Chemistry.
THE 1S1/2 BOUND STATE CORRECTIONS TO THE ELECTRON AND PROTON g FACTOR FOR ATOMIC HYDROGEN
Roger A. Hegstrom *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 417-420 refs (See N72-17330 08-14)
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N72-17398# Pennsylvania State Univ., University Park. Dept. of Physics.
ELECTROMAGNETIC INTERACTIONS OF HYDROGENIC ATOMS: CORRECTIONS TO g FACTORS
Howard Grotch *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 421-425 refs (See N72-17330 08-14)
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N72-17399*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RATIO OF ATOMIC g SUB J VALUES FOR HYDROGEN AND DEUTERIUM: A ISOTOPE EFFECT
H. G. Robinson (Duke Univ., Durham, N. C.) and William M. Hughes (Duke Univ., Durham, N. C.) *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 427-430 refs Sponsored by NSF and ONR (See N72-17330 08-14)
(NASA-TM-X-67530) Avail: NTIS; SOD $6.00 as C 13.10:343 CSCL 20H

N72-17400# Mainz Univ. (West Germany).
METHODS FOR LEPTON g-FACTOR ANOMALY MEASUREMENTS
G. Graeff *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 431-435 refs (See N72-17330 08-14)
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N72-17401# Michigan Univ., Ann Arbor. Harrison M. Randall Lab. of Physics.
PRELIMINARY RESULTS OF A NEW MEASUREMENT OF THE g-FACTOR ANOMALY OF THE FREE ELECTRON

John C. Wesley and Arthur Rich *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 437-442 refs Sponsored by AEC (See N72-17330 08-14)
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N72-17402# European Organization for Nuclear Research, Geneva (Switzerland).
MUON g-2 MEASUREMENTS
J. Bailey *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 443-445 refs (See N72-17330 08-14)
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N72-17889*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Environmental Sciences Div.
NONEQUILIBRIUM IONIZATION MEASUREMENTS IN HYDROGEN-HELIUM MIXTURES
L. P. Leibowitz *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 13-18 ref (See N72-17887 08-30)
Avail: NTIS CSCL 20H

N72-17616*# Oak Ridge National Lab., Tenn.
MONTE CARLO CALCULATIONS OF HIGH ENERGY NUCLEON MESON CASCADES AND APPLICATIONS TO GALACTIC COSMIC RAY TRANSPORT
T. W. Armstrong, R. G. Alsmiller, Jr., and K. C. Chandler *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 117-122 refs (See N72-17601 08-22)
(NASA Order H-38280A)
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N72-17650*# Iowa State Univ. of Science and Technology, Ames. Dept. of Nuclear Engineering.
APPLICATION OF THE MATRIX EXPONENTIAL KERNEL
Alfred F. Rohach *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 383-386 refs Sponsored by AEC (See N72-17601 08-22)
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N72-17654*# California Univ., Berkeley. Lawrence Radiation Lab.
HUMAN VISUAL RESPONSE TO NUCLEAR PARTICLE EXPOSURES
C. A. Tobias, T. F. Budinger, and J. T. Lyman *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 416-422 refs Sponsored jointly by NASA and AEC (See N72-17601 08-22)
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N72-17663*# Air Force Cambridge Research Labs., Bedford, Mass.
HARDENING ELECTRONIC DEVICES AGAINST VERY HIGH TOTAL DOSE RADIATION ENVIRONMENTS
B. Buchanan, W. Shedd, S. Roosild, and R. Dolan *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 481-486 refs (See N72-17601 08-22)
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N72-17664*# Oak Ridge National Lab., Tenn.
EXPERIMENTAL NUCLEAR CROSS SECTIONS FOR SPACECRAFT SHIELD ANALYSIS
R. W. Peelle *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 488-499 refs Sponsored by NASA and AEC (See N72-17601 08-22)
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N72-17666*# Oak Ridge National Lab., Tenn.
THE POPOP4 LIBRARY AND CODES FOR PREPARING SECONDARY GAMMA-RAY PRODUCTION CROSS SECTIONS
W. E. Ford, III *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 512-519 refs (See N72-17601 08-22)
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N72-17668*# Princeton-Pennsylvania Accelerator, Princeton, N.J.
ACCELERATOR MEASUREMENT OF THE ENERGY SPECTRA OF NEUTRONS EMITTED IN THE INTERACTION OF 3-GeV PROTONS WITH SEVERAL ELEMENTS
W. J. Nalesnik, T. J. Devlin (Rutgers Univ., New Brunswick, N. J.), M. Merker, and B. S. P. Shen *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 523-526 refs Prepared in cooperation with Pa. Univ. (See N72-17601 08-22)
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N72-17669*# Purdue Univ., Lafayette, Ind.
THE CALCULATION OF NEUTRON CAPTURE GAMMA-RAY YIELDS FOR SPACE SHIELDING APPLICATIONS
K. J. Yost *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 527-529 refs (See N72-17601 08-22)
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N72-17674*# Air Force Weapons Lab., Kirtland AFB, N.Mex. Technology Div.
A SUMMARY OF THE OV1-19 SATELLITE DOSE, DEPTH DOSE, AND LINEAR ENERGY TRANSFER SPECTRAL MEASUREMENTS
John T. Cervini *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 561-568 refs (See N72-17601 08-22)
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N72-17696*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE RESPONSE OF A 300 MICRON SILICON DETECTOR TO MONOENERGETIC NEUTRONS DETERMINED BY THE USE OF THE MONTE CARLO TECHNIQUE
M. Tahezadeh and G. Anno (Art Corp.) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 708-713 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

N72-17708*# TRW Systems Group, Redondo Beach, Calif.
PHOTON INDUCED SECONDARY ELECTRON EMISSION
R. B. Spencer, C. B. Smith, and E. J. McGrath *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 792-800 refs Prepared in cooperation with Norman Eng. Co.and Sci. Appl., Inc. (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

N72-17709*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRON AND BREMSSTRAHLUNG PENETRATION AND DOSE CALCULATION
John W. Watts, Jr. and Martin O. Burrell *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 801-815 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20H

N72-17710*# Oak Ridge National Lab., Tenn.
LOW-ENERGY ELECTRON TRANSPORT WITH THE METHOD OF DISCRETE ORDINATES
D. E. Bartine, R. G. Alsmiller, Jr., F. R. Mynatt, W. W. Engle, Jr., and J. Barish *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 816-820 refs (See N72-17601 08-22)
(NASA Order H-38280a)
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N72-17711*# Brookhaven National Lab., Upton, N.Y.
THE APPLICATION OF THE PHASE SPACE TIME EVOLUTION METHOD TO ELECTRON SHIELDING
Matthew C. Cordaro (Long Island Lighting Co.) and Martin S. Zucker *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 821-831 refs Sponsored by AEC (See N72-17601 08-22)
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N72-17712*# Science Applications, Inc., La Jolla, Calif.
PARAMETRIC FIT TO ELECTRON TRANSPORT PROPERTIES
J. A. Lonergan and D. C. Shreve *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 832-841 refs Sponsored by NASA (See N72-17601 08-22)
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N72-17858*# Translation Consultants, Ltd., Arlington, Va.
DETERMINATION OF THE LENGTH OF nn-SCATTERING IN EXPERIMENTS IN CAPTURING NEGATIVE MUONS WITH DEUTERONS
Yu. P. Nikitin *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 111-116 refs (See N72-17850 08-29)
Avail: NTIS CSCL 20H

N72-17859*# Translation Consultants, Ltd., Arlington, Va.
THE ABSORPTION OF POSITIVE AND NEGATIVE PIONS BY COMPLEX NUCLEI
A. I. Fesenko *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 117-127 refs (See N72-17850 08-29)
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N72-17860*# Translation Consultants, Ltd., Arlington, Va.
MEASUREMENT OF ELECTRON AND GAMMA-QUANTA ENERGIES IN HEAVY LIQUID BUBBLE CHAMBERS
A. T. Bederkin, V. S. Demidov, A. I. Ponosov, V. P. Protasov, and F. M. Sergeyev *In its* Elemantary Particles and Cosmic Rays, No. 2 Feb. 1972 p 128-154 refs (See N72-17850 08-29)
Avail: NTIS CSCL 20H

N72-17861*# Translation Consultants, Ltd., Arlington, Va.
DEVELOPMENT OF A METHOD FOR STUDYING ELECTRON TRACKS IN BUBBLE CHAMBERS WITH A HEAVY LIQUID AND STRONG PULSE MAGNETIC FIELDS
V. K. Makarin, N. N. Mukhin, A. S. Romantseva, I. A. Svetlolobov, M. M. Sulkovskaya, S. A. Chuyeva, and R. S. Shlyapnikov *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 155-169 refs (See N72-17850 08-29)
Avail: NTIS CSCL 20H

N72-17572# Israel Program for Scientific Translations, Ltd., Jerusalem.
CORRELATION FUNCTIONS AND SPECTRAL DENSITIES OF THE INTENSITY OF OUTGOING RADIATION OVER THE SPECTRAL RANGE 0.6-0.8 MICRONS (FROM MEASUREMENTS OF THE COSMOS-45 SATELLITE)
V. G. Boldyrev, D. M. Sonechkin, V. I. Tulupov, and I. S. Khandurova *In its* Probl. of Satellite Meteorol. 1970 p 75-80 refs (See N72-17562 08-20)
Avail: NTIS

N72-17250 Birkbeck Coll., London (England).
ELECTRONIC COLLISIONS
J. B. Hasted *In* ESRIN Mesospheric Models and Related Expts. 1971 p 220-230 refs (See N72-17235 08-13)
Copyright. Avail: Springer Verlag, New York; D. Reidel, Dordrecht, Neth.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N72-17786*# California Univ., Berkeley. Lawrence Radiation Lab. Dept. of Physics.
THE DARWIN MODEL AS A TOOL FOR ELECTROMAGNETIC PLASMA SIMULATION
Allan N. Kaufman and Peter S. Rostler 15 Sep. 1970 7 p refs Sponsored jointly by NASA and AEC
(NASA-CR-125569; UCRL-19859) Avail: NTIS CSCL 20I

The Darwin model of electromagnetic interaction is presented as a self-consistent theory, and is shown to be an excellent approximation to the Maxwell theory for slow electromagnetic waves. Since the fast waves of the Maxwell theory are absent, it is convenient for use in the computer simulation of the electromagnetic dynamics of nonrelativistic plasma. Author

N72-17787*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASURED CURRENT DRAINAGE THROUGH HOLES IN VARIOUS DIELECTRICS UP TO 2 KILOVOLTS IN A DILUTE PLASMA
Norman T. Grier and Daniel J. McKinzie, Jr. Washington Feb. 1972 20 p refs
(NASA-TN-D-6663; E-6668) Avail: NTIS CSCL 20I

The electron current drained from a plasma through approximately 0.05 cm diameter holes in eight possible space applicable dielectrics placed on a probe biased at voltages up to 2000 V dc have been determined both theoretically and experimentally. The dielectrics tested were Parylene C and N, Teflon FEP type C, Teflon TFE, Nomex, quartz 7940 Corning Glass, Mylar A, and Kapton H polymide film. A Laplace field was used to predict an upper limit for the drainage current. The measured current was less than the computed current for quartz, Teflon FEP, and the 0.0123 cm thick sample of Parylene N for all voltages tested. The drainage current through the other dielectrics became equal to or greater than the computed current at a voltage below 2000 V. The magnitudes of the currents were between 0.1 and 10 microamperes for most of the dielectrics.
Author

N72-17788*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESONANT DIFFUSION IN THE PRESENCE OF STRONG PLASMA TURBULENCE
T. J. Birmingham and M. Bornatici (European Space Res. Inst., Frascati, Italy) Dec. 1971 28 p refs Submitted for publication Revised
(NASA-TM-X-65693; X-641-71-320) Avail: NTIS CSCL 20I

The diffusion equation which describes the evolution of the average one particle distribution function for an ensemble of strongly turbulent plasmas is derived. The diffusion tensor is a time integral of the autocorrelation tensor of the fluctuations as observed by particles moving along statistically distributed orbits. These orbits contain the effects of fluctuations and thus differ from those encountered in weak turbulence theory. The plasma trajectory equations are used to relate each to the diffusion

tensor itself when the turbulence is electrostatic. The diffusion tensor is explicity evaluated for a strongly turbulent unmagnetized plasma. Author

N72-17789# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
PLASMA CONFINEMENT IN THE DECA-2 B CIRCULARIZED MAGNETIC WELL
D. Launois, P. Lecoustey, M. Nicolas, J. Tachon, and J. Kesner 1971 3 p refs In FRENCH; ENGLISH summary Presented at Phys. Conf., Evian, France, 25-29 May 1971
(CEA-Conf-1807; Conf-710527-8) Avail: AEC Depository Libraries

The plasma equilibrium is stable against flutes in spite of the shallow well of DECA 2 B. The ionic distribution function is minimum for a given angle at the beginning of the confinement. It changes during 600 microseconds to reach a maximum for the same value of this angle. The causes of this change are discussed. NSA

N72-17790# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
DISSIPATIVE INSTABILITY ASSOCIATED WITH ELECTRONS TRAPPED IN TOKAMAK-TYPE CONFIGURATIONS
J. C. Adam, G. Laval, and R. Pellat 1971 3 p refs In FRENCH; ENGLISH summary Presented at Phys. Conf., Evian, France, 25-29 May 1971
(CEA-Conf-1800; Conf-710527-1) Avail: AEC Despository Libraries

The influence of collisions on a localized instability due to trapped electrons in a toroidal configuration is studied. It is assumed that the frequency of the instability is greater than the ion bounce frequency but lower than the electron frequency. Author (NSA)

N72-17791# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
PARAMETER STUDY FOR A TRANSIT TIME MAGNETIC PUMPING EXPERIMENT IN A TORUS
M. Brambilla and S. Giuffre 1971 4 p refs Presented at 10th Intern. Conf. on Phenomena in Ionized Gases, Oxford, 13-18 Sep. 1971
(CEA-Conf-1830; Conf-710920-1) Avail: AEC Depository Libraries

Transit-time magnetic pumping is a slow process and must be performed in a machine already having good performances. It is shown that an experiment is possible in a stellarator or a Tokamak having the same size as the existing devices. NSA

N72-17792# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
PLASMA HEATING AT THE LOWER HYBRID RESONANCE
J. J. Capitain, G. Ichtchenko, P. Lallia, D. Moulin, T. K. Ngyuen, and S. S. Pesic 1971 4 p refs Presented at 10th Intern. Conf. on Phenomena in Ionized Gases, Oxford, 13-18 Sep. 1971
(CEA-Conf-1831; Conf-710920-4) Avail: AEC Depository Libraries

In order to investigate the efficiency of noncollisional absorption mechanisms at high frequencies, an experimental study of the lower hybrid heating of a dense laser-produced plasma was made. The lower hybrid resonance occurred when the electron density was 2 x 10 to the 14th power/cu cm. The absorption of a small part of the incident power must be sufficient to make the collisionless contribution to the heating lower than the collisional one. NSA

N72-17793# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ELECTROSTATIC INSTABILITIES IN A TWO-COMPONENT ANISOTROPIC PLASMA
J. Jacquinot and C. Leloup 1971 4 p refs Presented at the 10th Intern. Conf. on Phenomena in Ionized Gases, Oxford, England, 13-18 Sep. 1971
(CEA-Conf-1828; Conf-710920-8) Avail: AEC Depository Libraries

Anisotropy-driven electrostatic instabilities near the electron cyclotron frequency and its harmonics seem to play an important role in hot electron plasmas confined in a mirror geometry. In all the experiments that exhibit the instability, a cold plasma coexists with the hot population, the ratio of the cold to the hot densities varying between 1 and 100. The growth rate and marginal stability conditions were calculated, taking into account the cold plasma effects. Numerical solutions are given for an anisotropy ratio theta = 8. NSA

N72-17794# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
NONLINEAR HARMONIC GENERATION IN A THERMAL MAGNETIZED PLASMA
R. Cano, I. Fidone, M. J. Schwartz, and B. Zanfagna [1971] 4 p ref Presented at 10th Intern. Conf. on Phenomena in Ionized Gases, Oxford, 13-18 Sep. 1971
(CEA-Conf-1835; Conf-710920-2) Avail: AEC Depository Libraries

An experiment is discussed in which a radiation was observed at the second harmonic of an incident microwave beam. The experimental results are in good agreement with the theory of nonlinear harmonic generation in inhomogeneous plasmas. NSA

N72-17795# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
LOWER-HYBRID WAVE-PLASMA INTERACTION
S. S. Pesic [1971] 4 p refs Presented at 10th Intern. Conf. on Phenomena in Ionized Gases, Oxford, 13-18 Sep. 1971
(CEA-Conf-1827; Conf-710920-9) Avail: AEC Depository Libraries

In order to estimate the role of the boundedness of laboratory plasmas in wave energy transfers, the interaction between obliquely incident electromagnetic waves and a nonuniform plasma column confined in an axial static magnetic field was analyzed. The influence of the particle thermal motion on wave absorption by the cold plasma was investigated. NSA

N72-17796# Japan Atomic Energy Research Inst., Tokai. Tokai Research Establishment.
MEASUREMENT OF THE PLASMA CURRENT DISTRIBUTION IN A TOKAMAK DEVICE WITH ALPHA PARTICLES INJECTED TRANSVERSE OR PARALLEL TO THE TOROIDAL AXIS
S. Kawasaki, K. Inoue, T. Takeda, and M. Yoshikawa Jul. 1971 31 p refs
(JAERI-Memo-4531) Avail: AEC Depository Libraries

A method is proposed for measuring the current distribution in a Tokamak plasma column by injecting alpha particles from a radioisotope. In this method, the plasma current distribution is determined by injecting the alpha particles into a plasma column and analyzing their orbits with and without the plasma current. The orbit analysis is presented for the axisymmetric linear geometry. The deviation calculated for the JFT-2 Tokamak parameters indicates that the present method is feasible. The problems of measurement resolution, toroidal effect, alpha source, and detector are also described. Author (NSA)

N72-17797# Paris Univ., Orsay (France). Lab. de Physique des Plasmas.
HIGH-FREQUENCY RESONANT PLASMAS
M. Moisan May 1971 111 p refs In FRENCH; ENGLISH summary
(NP-19031; LP-130) Avail: AEC Depository Libraries

A new type of high frequency plasma is described that is particularly well adapted to the experimental demonstration of the parametric instabilities predicted by V.P. Silin, Yu. M. Aliev,

and E. Ferlenghi and also Nishikawa, Dubois, and Goldman. Extremely intense high frequency fields are developed with the plasma. The experimental arrangement and the properties of the plasma over its operating regions are described in detail. It is shown that the behavior of the high frequency plasma can be clearly interpreted on the basis of plasma resonances. NSA

N72-17798# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
ON THE VALIDITY OF THE QUASI-LINEAR APPROXIMATION FOR TURBULENT PLASMAS
D. Biskamp and H. Welter Mar. 1971 41 p refs
(IPP-6/94) Avail: AEC Depository Libraries

Theoretical conditions for applicability of the quasi-linear theory (QLT) are formulated. To investigate the importance of these conditions, numerical experiments are performed on two different types of weak one-dimensional plasma instabilities. It is found that the behavior of the bump-in-tail instability is consistent with QLT (saturation field energy) if these conditions are satisfied, while in the opposite case, trapping stabilization is important. The weak symmetric two-stream instability never satisfied the criterion for validity of QLT, since all particles that are supposed to diffuse are trapped. The first saturation level predicted by QLT is the same as given by the condition for trapping stabilization. The important deviation in this case from weakly turbulent behavior is apparent from the coherent-mode coupling process, which becomes (relatively) stronger, the weaker the instability. Author (NSA)

N72-17799# Sandia Labs., Albuquerque, N.Mex.
EFFECTS OF RF ACTIVATED INERT GAS PLASMAS ON CRITICAL SURFACE TENSION AND BONDABILITY OF POLYDIMETHYL SILICONES AND POLYETHYLENE
R. R. Sowell, N. J. DeLollis, H. J. Gregory, and O. Montoya Sep. 1971 12 p refs
(SC-RR-71-0483) Avail: NTIS

An RTV silicone and pure polyethylene were exposed to argon and helium plasmas and showed increases in critical surface tension of wetting. After treatment, wettability of plasma-treated silicone surfaces decreased with time, and strengths of adhesive bonds made at later time intervals showed a corresponding decrease. On the other hand, the failure mode of bonds made immediately after treatment did not change with time. The contact angles measured always decreased on the materials studied, indicating an increase in surface energy. The results contradict the hypothesis that wetting is of minor importance in adhesion. Author

N72-17800# Texas Univ., Austin. Center for Plasma Physics and Thermonuclear Research.
TEXAS TURBULENT TORUS EXPERIMENT Progress Report
May 1971 23 p refs
(ORO-4087-1) Avail: NTIS

This investigation was undertaken to determine whether ohmic heating can be used to heat a Tokamak plasma to thermonuclear temperature if the resistivity is artificially enhanced by the generation of strong turbulence in the plasma. The current status of the experiment is discussed. Author NSA

N72-17801# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
SIMPLE LOW-LOSS COUPLING METHOD FOR RF HEATING OF PLASMA IONS BY ELECTROSTATIC ION-CYCLOTRON WAVES
S. Puri and M. Tutter Aug. 1971 11 p refs
(IPP-IV-25) Avail: AEC Depository Libraries

Excitation of TEM waves is proposed in a cylindrical coaxial waveguide consisting of a metallic outer conductor with the plasma acting as the inner conductor. For frequencies of the order of the ion gyrofrequency, the penetration depth of the TEM wave fields into the plasma generally exceeds the wavelength of the electrostatic ion cyclotron waves. The electrostatic ion cyclotron waves thus excited propagate radially into the plasma and are collisionally absorbed if the time of energy propagation (at the wave's group velocity) over a distance of plasma diameter is of the order of, or greater than, the energy equipartition time due to ion-ion collisions. Numerical calculations for some representative examples indicate that this method could be used to heat plasma ions with a rather high efficiency. Author (NSA)

N72-17802# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
OPTICAL METHOD FOR STUDYING THE ION VELOCITY IN AN ACCELERATED PLASMA BEAM
W. R. Hess [1971] 4 p refs Presented at 10th Intern. Conf. on Phenomena in Ionized Gases, Oxford, 13-18 Sep. 1971
(CEA-Conf-1829; Conf-710920-7) Avail: AEC Depository Libraries

Charge exchange with excitation from energetic ions in a residual neutral gas in plasma experimental devices can be used for plasma diagnostics. An optical method for measuring the proton velocity distribution in a hot plasma source is described. NSA

N72-17803# Japan Atomic Energy Research Inst., Tokyo.
MICROWAVE INTERFEROMETRIC MEASUREMENTS IN THE MEDIUM-BETA TORUS (JFT-2)
Akimasa Funahashi and Satoshi Itoh Jul. 1971 24 p refs In JAPANESE; ENGLISH summary
(JAERI-Memo-4530) Avail: AEC Depository Libraries

Eight-channel, 2-mm microwave interferometric measurements were made in order to determine the distribution of plasma density in the Tokamak-type apparatus, JFT-2. The plasma density measurements performed in Tokamak apparatus are first reviewed. Then, the 2-mm wave measurements in the JFT-2 apparatus are explained in detail, including the multichannel interferometric circuits and the numerical method of determining the density distributions without axial symmetry from the measured phase shifts. In addition, the refractive shift of the 2-mm wave path due to the radial distribution of plasma density is also discussed. The report is expected to be a manual for obtaining the density distributions from the observed interferometric traces. Author (NSA)

N72-17804# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
SIDE-ON INTERFEROMETRY AT WAVE LENGTH 10.6 MUm IN THETA-PINCH PLASMAS
A. Daerr, G. Decker, and H. Roehr May 1971 26 p refs In GERMAN; ENGLISH summary
(IPP-1/117) Avail: AEC Depository Libraries

An experiment for measuring spatially resolved electron density by interferometry at 10.6 microns is described. The experiment was performed on a theta-pinch plasma. The intention was to prove the feasibility of this technique for use on toroidal pinches. A transverse pumped CO2 laser of some MW power served as the radiation source. A Mach-Zehnder interferometer was chosen. An area detector of simple construction was developed and used to make the interference fringes visible. In order to make the discharge vessel (quartz) transparent for the 10.6 microns radiation, BaF2, glass windows were inserted. Some examples of measured density profiles show that this method may be used very effectively on toroidal plasma machines. Author (NSA)

N72-17805# Atomic Energy Commission, Washington, D.C.
CHARACTERISTICS OF COLLISIONLESS DAMPING OF ELECTROMAGNETIC WAVE IN A REGION OF INTENSE INHOMOGENEITY OF A COLD PLASMA
V. V. Dolgopolov and A. Ya. Omelchenko [1971] 17 p refs Transl. into ENGLISH from Russian report KHFTI-69-53 of Akad. Nauk Ukr. SSR, Kharkov
(AEC-TR-7272; KHFTI-69-53) Avail: NTIS

The electromagnetic oscillations caused by initial perturbations were studied at the boundary of a semi-infinite plasma with a vacuum and in an inhomogeneous plane parallel layer of plasma. It was demonstrated that the surface waves caused by an initial perturbation are transferred into Langmuir-type oscillations. In the general case (at an arbitrary relationship between wave length and typical inhomogeneity), as a result of the development of initial perturbation in plasma, the Langmuir oscillations will remain. The effective wave vector of these oscillations in the direction of the plasma's density gradient increases without limit with time. Author (NSA)

N72-17806# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
DIELECTRIC PROPERTIES OF PLASMA PENETRATED BY THE HELICON WAVE AND ITS INFLUENCE ON MICROINSTABILITIES IN THE CASE OF ANISOTROPIC ION TEMPERATURES
J. Teichmann 1971 4 p refs Presented at 10th Intern. Conf. on Phenomena in Ionized Gases, Oxford, 13-18 Sep. 1971
(CEA-Conf-1826; Conf-710920-10) Avail: AEC Depository Libraries

The influence of the helicon wave upon several kinds of microinstabilities has been discovered recently. The effect observed is due to the particular properties of the plasma HF field system. The changes observed in the plasma dielectric properties when submitted to a strong HF field were studied. Only microinstabilities generated by the anisotropy of the ion temperature were considered. NSA

N72-17807# Oak Ridge National Lab., Tenn.
EVALUATION OF THE PLASMA DISPERSION FUNCTION
E. A. Ferguson Oct. 1971 18 p refs Sponsored by AEC
(ORNL-TM-3610) Avail: NTIS

A version of the FRDCNT subroutine, which evaluates the plasma dispersion function, was written. The routine uses numerical integration and an asymptotic expansion method. The version of FRDCNT gives results which have relative errors less than 10 to the -6th power for all arguments for which the plasma dispersion function is greater than .0001 and absolute errors less than 10 to the -6th power for all other arguments. The routine is written in FORTRAN using double precision. It was optimized with respect to calculation time, and in comparison tests with other known codes for similar accuracy, checks out to be the fastest. Author (NSA)

N72-17808# Academy of Sciences (USSR), Moscow. Inst. Fiziki.
LASER PLASMA INJECTION INTO A STELLARATOR
E. D. Andryukhina, R. Blanken, G. O. Voronov, N. P. Donokaya, M. S. Rabinovich, A. D. Smirnova, O. I. Fedyanin, Yu. V. Kholnov, and I. S. Shpigel 1971 11 p refs In RUSSIAN and ENGLISH
(NP-19055) Avail: AEC Depository Libraries

A plasma was produced by laser beam irradiation of a lithium target inside the TOR 1 stellarator. The dependence of the density, electron temperature, potential of the trapped plasma and pressure on the laser energy, size of the focal spot, position of the target, and strength of the magnetic field were studied. NSA

N72-17809# Paris Univ., Orsay (France).
INSTABILITY IN TEMPERATURE ANISOTROPY OF A COLLISIONLESS PLASMA. LINEAR DESCRIPTION AND QUASILINEAR EVOLUTION Ph.D. Thesis
Carlos MontesLozano [1970] 101 p refs In FRENCH
(FRNC-TH-108) Avail: AEC Depository Libraries

Instability in temperature anisotropy was studied in the case of a plasma in which this instability is assumed to be determined only by the electron space charge. The plasma is assumed to be collisionless and not submitted to an external magnetic field, which results in high temperatures and low densities. Certain anisotropic plasmas met in astrophysics correspond to the conditions specified (e.g., the solar wind remote from the sun). The various unstable modes of this type of plasma were studied in detail, taking into account the ion dynamics. Relaxation in the temperature anisotropy by quasi-linear coupling of the particles with the unstable modes was also studied. NSA

N72-17810# Paris Univ., Orsay (France). Faculte des Sciences.
STATIC BEHAVIOR AND INSTABILITIES OF THE Cs PLASMAS PRODUCED BY CONTACT IONIZATION IN SEALED TUBES Ph.D. Thesis
J. B. Moreau 1970 127 p refs In FRENCH
(FRNC-TH-87) Avail: AEC Depository Libraries

The properties of Cs plasma produced in sealed tubes were studied. A very short pulse method intended to obtain the characteristics point by point was developed. A macroscopic theory was used to explain the properties of instabilities occurring under certain operating conditions. The principal parameters considered were: magnetic field, pressure, ion temperature, and electron longitudinal velocity, and limits for the existence of these instabilities were precisely determined. Several tubes were developed. NSA

N72-17811# Royal Inst. of Tech., Stockholm (Sweden).
EXAMPLE OF THE MAGNETIC LINE-TYPING EFFECT ON THE FLUTE INSTABILITY
B. Lehnert Nov. 1970 9 p refs
(NP-19065) Avail: AEC Depository Libraries

The magnetic line-tying effects on flute-type instability were studied in a simple special case where the plasma is supported against gravity by a horizontal magnetic field and is bounded in the field direction by two vertical metal plates of finite electric conductivity. The growth rate of the instability was found to be strongly reduced by the plates, even at moderately high conductivities. Author (NSA)

N72-17812# Joint Publications Research Service, Washington, D.C.
SPECTRA OF TURBULENCE OF WHISTLERS IN COLLISIONLESS PLASMA
M. A. Lifshits and V. N. Tsytovich Oct. 1971 16 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Moscow. Inst. Fiz., report NP-18482
(AEC-TR-7275; NP-18482; Preprint-100) Avail: NTIS

Studies of nonlinear interactions and spectra of stationary turbulence of whistlers (helicons) showed that the law of conservation limited considerably the decay interactions of whistlers, although the matrix elements for the whistler decay interactions, exceeded the matrix elements for scattering on ions. Formulas obtained for induced scattering on ions also showed that the stationary solutions corresponded to the whistler energy collapse in the direction of the external magnetic field and formation of one-dimensional spectra. The decay of such waves is strongly forbidden. In the case of prevailing induced scattering on electrons, the stationary spectrum existed only in some specific instances. NSA

N72-17813# Rochester Univ., N.Y.
[NONLINEAR BEHAVIOR OF UNSTABLE PLASMA IN THRESHOLD REGIME] Annual Progress Report
Albert Simon 15 Sep. 1971 6 p refs
(Contract AT(30-1)-3942)
(UR-3942-11) Avail: NTIS

Research progress on flute instabilities in fully ionized, collisionless, low density plasmas in simple mirror machines is reported. Drift instabilities in a collisional fully ionized plasma in a Q device are also studied. A summary of each study is given. NSA

N72-17814# Rochester Univ., N.Y.
NONLINEAR THEORY OF THE MIRROR FLUTE INSTABILITY

A. Simon and C. I. Weng [1970] 5 p refs Presented at Conf. on Plasma Theory, Kiev, USSR, 19 Oct. 1971
(Contract AT(30-1)-3942)
(UR-3942-10; Conf-711016-2) Avail: NTIS

The method of small amplitude nonlinear threshold analysis was used to study this instability. Using a set of equations with constant gravity, the nonlinear analysis predicts small amplitude saturation and nonexplosive behavior. However, allowing for nonconstant gravity, a higher frequency mode which is introduced no longer saturates and produces explosive behavior. NSA

N72-17815# Institut Atomnoi Energii, Moscow (USSR).
ROLE OF ION SOUND DURING ELECTRON CYCLOTRON HEATING
A. A. Ivanov 1970 55 p refs In RUSSIAN
(IAE-2058) Avail: AEC Depository Libraries

A study was made of the phenomenon of stochastic heating of plasma electrons in the presence of electron cyclotron heating. Cyclotron heating of electrons is studied in the quasi-linear approximation. The problem of stochastic heating is discussed in detail. It turns out that, as a result of decay into ion sound and a hybrid wave and their converse confluence, the initially monochromatic cyclotron wave is broadened to such an extent that the ordinary quasi-linear theory of waves with merged phases is applicable to them. The solution of the quasi-linear equation gives estimates of the limiting electron temperatures. The appearance of a group of hot electrons is explained, and it is demonstrated that all the particles drift into the loss cone with time. Author (NSA)

N72-17816# Paris Univ. (France). Faculte des Sciences.
STUDY OF GRID EXCITED ION WAVES IN A COLLISIONLESS PLASMA Ph.D. Thesis
Dominique Gresillon 1970 96 p refs In FRENCH
(FRNC-TH-66) Avail: AEC Depository Libraries

A linear microscopic theory of ion dynamics and waves in single-ended, collisionless Q machine plasmas is presented. The actual supersonic drifting plasma and the wave excitation method are taken into account. The excitation coefficients for normal ion modes are calculated. Two main normal modes are found: one slower, the other faster than the plasma mean velocity. In the very-low-frequency limit, and near the source, their sum acts so as to give a free streaming of the modulated plasma flow. When going higher in frequency and farther from the source, the more-damped slow wave disappears, leaving only the fast one. The first-order ion distribution is developed. This development makes explicit the general solution of the Vlasov equation as a sum of free mode and normal mode. NSA

N72-17817# Royal Inst. of Tech., Stockholm (Sweden).
FUSION DEVICES FOR PLASMAS ROTATING AT SUPER CRITICAL VELOCITIES
B. Lehnert Sep. 1970 17 p refs
(NP-19066) Avail: AEC Depository Libraries

It is shown that the velocity limitation observed in at least some types of rotating plasma devices is caused by an enhanced plasma-neutral gas interaction at the end walls which bound the plasma in the magnetic field direction. A considerable amount of nonthermal ions should be produced by the backscatter of neutrals from these walls. If the mechanism underlying the plasma-neutral gas interaction is due to the generation of such ions, or to some other process which forms azimuthal electric field inhomogeneities, it should become possible to eliminate the velocity limitation by short-circuiting the azimuthal electric field. If these predictions are true, new possibilities will open up in the use of rotating plasmas. In particular, the power losses due to ions and electrons escaping from a rotating plasma device can then be kept small enough to balance the thermonuclear power at high temperatures. This would be the case for technically realizable beta values, plasma densities, and magnetic field strengths. At the same time a strong confinement can only be achieved by the centrifugal force at very large rotational velocities and applied voltages, the technical feasibility of which has to be further analyzed. Author (NSA)

N72-17818# Royal Inst. of Tech., Stockholm (Sweden).
DIVISION OF PLASMA PHYSICS AND FUSION RESEARCH Progress Report, 1970
B. Lehnert Jul. 1970 48 p refs
(NP-19064) Avail: AEC Depository Libraries

The lines of research are summarized, and obtained results and future plans are presented. The activities are mainly concentrated on basic plasma physics and its application to the thermonuclear fusion problem, but other fields are also involved in the research program: (1) cosmic physics, (2) special technical applications of plasmas, and the development of diagnostic methods and experimental devices. Author (NSA)

N72-17819# Stanford Univ., Calif. Inst. for Plasma Research.
RADIATION AND RELATED PROCESSES IN PLASMAS
P. A. Sturrock, P. C. W. Fung, C. E. Newman, and R. I. Epstein Nov. 1971 14 p refs
(Contract N00014-67-A-0112-0062; NR Proj. 323-009)
(AD-732792) Avail: NTIS CSCL 20/9

The paper is concerned with radiation and related processes in plasmas, including single particle and collective emission processes and the reaction of these processes on the particle distribution function to produce acceleration and diffusion. The principal objective is the study of radiation processes occuring in geophysical, interplanetary and astrophysical plasmas. A secondary objective is the study of various mathematical approaches which have been proposed for the study of radiation, with the aim of evaluating and comparing these methods. Author (GRA)

N72-17475# Michigan State Univ., East Lansing. Dept. of Chemistry.
PLASMA FORMATION UPON LASER IRRADIATION OF TRANSPARENT DIELECTRIC MATERIALS BELOW THE DAMAGE THRESHOLD
B. E. Henderson, R. R. Getty, G. E. Leroi, and D. L. Rousseau (Bell Telephone Labs., Inc., Murray Hill, N. J.) *In* NBS Damage in Laser Mater. Nov. 1971 p 31-36 refs Sponsored in part by ONR (See N72-17470 08-16)
Avail: SOD $1.50 as C13.10:356

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N72-17820* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF MANUFACTURING SEMICONDUCTOR DEVICES USING REFRACTORY DIELECTRICS Patent
Robert C. Trent, inventor (to NASA) Issued 7 Sep. 1971 6 p Filed 2 Oct. 1967
(NASA-Case-XER-08476-1; US-Patent-3,602,984; US-Patent-Appl-SN-672388; US-Patent-Class-29-578; US-Patent-Class-29-589; US-Patent-Class-1-148-187) Avail: US Patent Office CSCL 20L

A process is described for making semiconductor devices with refractory dielectrics as diffusant masks and interconnection insulating materials. The refractory dielectric is deposited onto a semiconductor wafer and an aperture is created that extends through the dielectric to the wafer. An impurity is then diffused into the wafer at the aperture and a semiconductor junction is created. Further junctions can be created by applying a second deposition of the refractory dielectric and then performing further aperture creating and impurity diffusing operations. Alternatively, a thermally grown dielectric can be grown in the first aperture and a second aperture can be created through the dielectric. A further impurity is then diffused into the wafer at the second aperture. Official Gazette of the U.S. Patent Office

N72-17821*# Scientific Translation Service, Santa Barbara, Calif.
SOLID STATE PHYSICS. VARIATIONS OF THE LATTICE PARAMETER OF THE THREE VARIETIES OF SOLID WURTZITE IN THEIR RESPECTIVE REGIONS
C. Carel, D. Weigel, and P. Vallet Washington NASA Feb. 1972 6 p refs Transl. into ENGLISH from Comptes Rendus (Paris), v. 260, no. 16, 21 Apr. 1965 p 4325-4328
(Contract NASw-2035)
(NASA-TT-F-14146) Avail: NTIS CSCL 20L

The Debye-Scherer X-ray method (lambda = 1.93597 A) was used to determine the structure of wurtzite. Lattice parameters a sub i were determined as a function of quenching temperature and composition. Author

N72-17822*# National Research Corp., Cambridge, Mass.
STUDY OF STRUCTURAL BEHAVIOR OF THIN FILMS
Frank Feakes Mar. 1971 51 p refs
(Contract NASw-2094)
Avail: NTIS CSCL 20L

The work directed towards developing methods of increasing the strength of thin boron films is reported. The program was divided into two main parts. The first involved the improvement of methods for the measurement of the strength of thin films. The second was a study of the effect of condensation of deposition temperature on the strength of the films. Techniques were developed for depositing boron films onto both sides of thin titanium and tantalum foils. Small dogbone sections of boron were made by masking. Strain gauges were then mounted on these to measure failure strains when the films were loaded in tension. Test results were consistent with those obtained by flexure tests. The most important flaws in the boron films appeared to have been generated by either small globules of boron ejected from the melt or small particles (possibly boron dust) on the substrate prior to deposition. Author

N72-17823# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
BASAL DISLOCATION INTERACTIONS WITH A FOREST OF NON BASAL DISLOCATIONS IN ZINC
N. Nagata 1971 26 p refs Sponsored by AEC
(CALT-767-P-3-18) Avail: NTIS

The mobility of basal dislocations in 99.999% pure zinc crystals with controlled densities of non-basal forest dislocations was measured as a function of stress at temperatures of 298 K and 84 K. The range of the forest dislocation density was 100 to 1,000,000/sq cm and the range of the resolved shear stress was 0 to 34,200,000 dynes/sq cm. The mobility of dislocations was characterized by three distinct regions: a low stress region showing no dislocation motion, a high stress region with a linear velocity-stress relationship, and in between, a transition region, similar to the theoretical predictions. The critical stress for basal edge dislocation motion was found to be proportional to the square root of the forest density and to be temperature independent. A temperature dependent critical stress for basal screw dislocations was observed. A strong interaction between basal dislocations and forest dislocations is indicated. In the high stress region where dislocation velocity is a linear function of the stress the velocity is independent of the forest density. The values of drag coefficient B in this region are in good agreement with those previously reported for specimens with low forest densities (100 to 1000/sq cm). Author

N72-17824# California Univ., Berkeley. Lawrence Radiation Lab.
HETEROGENEOUS DISLOCATION IN GaAs
R. Osiecki and G. Thomas Jun. 1971 7 p refs Presented at 2d Intern. Conf. on High Voltage Electron Microscopy, Stockholm, Sweden, 14 Apr. 1971
(Contract W-7405-eng-48)
(UCRL-20525; Conf-710439-1) Avail: NTIS

High voltage electron microscopy was used to study the n(±)/n(-)/n(+)regions of gallium arsenide. Specimens were prepared by chemical thinning, and a small amount of material was removed from the epitaxial layer, bringing the interface closer to a free surface. Defects were found at the free surface and the epitaxial/epitaxial interface. It is presumed that these dislocations are generated heterogeneously by impurities which formed during fabrication and were punched out by thermal stresses upon cooling. Diagrams showing the dislocations are included. F.O.S.

N72-17825# California Univ., Berkeley. Lawrence Radiation Lab.
DISLOCATION CONTRAST AT HIGH VOLTAGES
R. Osiecki, L. C. DeJonghe, W. K. Bell, and G. Thomas Jun. 1971 8 p refs Presented at 2d Intern. Conf. on High Voltage Elec. Microscopy, Stockholm, Sweden, 14 Apr. 1971
(Contract W-7405-eng-48)
(UCRL-20700; Conf-710439-2) Avail: NTIS

Beam contrast calculations for systematic orientations indicated that high order reflections at high voltages provide improved dislocation resolutions. Experimental confirmation is provided that high order systematic reflections result in an improvement in bright field image resolution, e.g., image widths of dislocations can be reduced by a factor of approximately 3. The results have been obtained from (001) foils of GaAs semiconducting devices in which dislocations are associated with surface and interfacial defects. In each case the crystal is set at the exact Bragg condition for each reflection along the systematic row being used. Author

N72-17826# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
DISLOCATION MOBILITY IN COPPER AND ZINC AT 44 K
K. M. Jassby and T. Vreeland, Jr. 1970 7 p refs Sponsored by AEC
(CALT-767-P-3-16) Avail: NTIS

Copper and zinc test crystals in the form of cylinders 1.27 cm in diameter and approximately 1 cm long, were prepared and tested in the torsion apparatus. Measurements of edge dislocation displacement versus distance from the cylindrical axis of the crystal are shown for copper. For zinc it was possible to draw straight line asympotes for dislocation displacement as a function of the radius, directly from the Berg-Barrett X-ray topographs. It was noted that in copper, dislocation displacement is linearly proportional to the radius. The results obtained were inconsistent with the electron viscosity model for dislocation damping and the experimental results which support that behavior. Author

N72-17827# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
MEASUREMENT OF DISLOCATION DAMPING FORCES AT HIGH DISLOCATION VELOCITY
K. M. Jassby and T. Vreeland, Jr. 1971 17 p refs Sponsored by AEC
(CALT-767-P-3-15) Avail: NTIS

In direct mobility experiments in single crystals, dislocation velocity is studied as a function of stress by the application of short-duration stress pulses. The stress pulse consists of a loading wave, followed microseconds later, by an unloading wave. At high velocities, dislocation inertia effects become important only if the dislocation damping force is a decreasing function of velocity. In general, the magnitude of this force can be determined only if the relative velocity between the applied stress wave and the dislocation is considered. Author

N72-17828# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
EXPERIMENTAL DETERMINATION OF THE LINE ENERGY OF A BASAL SCREW DISLOCATION IN ZINC
N. Nagata, K. M. Jassby, and T. Vreeland, Jr. 1971 20 p refs Sponsored by AEC
(CALT-767-P-3-17) Avail: NTIS

The critical breakaway stress was measured for basal edge dislocation in zinc specimens with strongly pinned ends and initial lengths which varied from 0.0005 to 0.033 cm. A line energy of 2.9 dyne cm/cm for a screw oriented dislocation which is parallel to, and approximately 0.5 microns below, a free surface, is deduced from these measurements. Author

N72-17829# Los Alamos Scientific Lab., N.Mex.
ENERGY STORAGE AND SWITCHING WITH SUPERCONDUCTORS
H. L. Laquer and F. L. Ribe 1971 3 p Presented at the Intern. Working Session on Fusion Reactor Technol. Conf., Oak Ridge, Tenn., 1 Jul. 1971
(LA-DC-12990) Avail: NTIS

Inductive magnetic energy storage with superconductors or cryogenic aluminum conductors is discussed in regard to its use in providing the magnetic fields needed in pulsed thermonuclear reactors and in some large-scale pulsed plasma physics experiments designed to demonstrate the scientific feasiblity of controlled fusion. NSA

N72-17830# Marquette Univ., Milwaukee, Wis. Coll. of Engineering.
STUDY OF THE DEFECT STRUCTURE OF NONSTOICHIOMETRIC CeO2 Technical Progress Report
Robert N. Blumenthal Sep. 1971 22 p refs
(Contract AT(11-1)-1441)
(COO-1441-15) Avail: NTIS

The electrical conductivity of sintered specimens of nonstoichiometric C3(1 + y)O2 was measured as a function of temperature from 1000 to 300 C and composition from 0.00214 < or = y < or = 0.0977. These results were described in terms of high and low temperature regions. Each region was characterized by an exponential dependence on temperature. The temperature of the intersection between the high and low temperature regions for each composition was compared with the composition-temperature dependence of the miscibility gap. The temperature dependence in the high temperature region was attributed to a change in both the carrier concentration and carrier mobility. The conductivity of sintered specimens of CaO-doped CeO2 (0.2 to 7.0 mole %) was also measured over the temperature range 700 to 1500 C and from 1 to 10 to the -22nd power atm of oxygen. All the specimens exhibited mixed conduction. The electrical conductivity was rationalized in terms of a defect model involving nonstoichiometric defects (ionozed cerium interstitials and localized electrons) and impurity-generated defects (doubly ionized oxygen vacancies).
Author (NSA)

N72-17831# Marquette Univ., Milwaukee, Wis. Coll. of Engineering.
TEMPERATURE DEPENDENCE OF THE ELECTRICAL CONDUCTIVITY OF NONSTOICHIOMETRIC Ce(1 PLUS y)O2
R. N. Blumenthal and R. L. Hofmaier [1971] 35 p refs Sponsored by AEC
(COO-1441-13) Avail: NTIS

The electrical conductivity of sintered specimens of nonstoichiometric Ce(1+y)O2 was measured as a function of temperature from 1000 to 300 deg C as well as a function of composition over the range 0.00214 less than or equal to y less than or equal to 0.0977. These results were described in terms of a high temperature and low temperature region. In both temperature regions, the conductivity exhibits an exponential dependence on temperature. In the high temperature region, the activation energy increased with increasing values of y. The activation energy, 0.61 + or - .03 eV, in the low temperature region was independent of y. The temperature of the intersection between the high and low temperature regions for each composition was compared with the composition-temperature dependence of the miscibility gap reported by Brauer and Gingerich. The temperature dependence of the conductivity in the high temperature region was attributed to a change in both the carrier concentration and carrier mobility. Author (NSA)

N72-17832# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
LEED-AES-EID STUDIES OF LITHIUM HYDRIDE
R. E. Clausing, G. L. Powell, and C. E. Holcombe, Jr. 1971 14 p refs Presented at the ASM 53d Metal Show and Mater. Eng. Congr., Detroit, 18-21 Oct. 1971
(Contract W-7405-eng-26)
(Y-DA-4246; Conf-711018-1) Avail: NTIS

A study of the (100) surface of LiH was made using low energy diffraction, Auger emission spectroscopy, and electron induced emission. The results are explained by postulating a surface excess of Li epitaxially fixed to the LiH substrate. The ratio of H-to-Li probably varied from approximately 0 at the surface to near unity a few atomic layers below. The surface structure is determined by the balance between the steady state thermal desorption of Li and H from the first monolayer and the diffusion of hydride ions and H through the surface concentration gradient. NSA

N72-17833# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
NOTE ON THE BAND GAPS OF SEMICONDUCTOR ALLOYS
David Stroud Jul. 1971 11 p refs
(Contract AT(30-1)-3699)
(NYO-3699-61) Avail: NTIS

It is shown, on the basis of perturbation theory and a simple assumption about the matrix elements of the scattering potential, that the close up effect of alloy disorder is inevitably to reduce the band gap of a semiconductor alloy below its virtual-crystal value. The conclusion is found to be in agreement with existing experiments and calculation. Author

N72-17834# National Bureau of Standards, Washington, D.C.
METHODS OF MEASUREMENT FOR SEMICONDUCTOR MATERIALS, PROCESS CONTROL, AND DEVICES Quarterly Report, 1 Jan. - 31 Mar. 1971
W. Murray Bullis Oct. 1971 57 p refs See also rept. dated Aug. 1971, AD-728611
(AD-732553; NBS-TN-598) Avail: NTIS CSCL 20/12

The report describes NBS activities directed toward the development of methods of measurement for semiconductor materials, process control, and devices. Significant accomplishments during the reporting period include application of tuning and other related procedures for ultrasonic wire bonders in an industrial environment with a reported reduction of rejection rate at visual inspection by more than a factor of two, more complete evaluation of the photovoltaic method for determining radial resistivity profiles of circular semiconductor wafers, and identification of test conditions in which a d-c calibration curve may properly be used in measurements of thermal resistance. Work is continuing on measurement of resistivity, carrier lifetime, and electrical inhomogeneities in semiconductor crystals; specification of germanium for gamma-ray detectors; evaluation of wire bonds and die attachment; measurement of thermal properties of semiconductor devices, transit-time and related carrier transport properties in junction devices, and electrical properties of microwave devices; and characterization of silicon nuclear radiation detectors. Supplementary data concerning staff, standards committee activities, technical services, and publications are included as appendixes. Author (GRA)

N72-17835# Watervliet Arsenal, N.Y.
MECHANISM OF COBALT ALUMINATE SPINEL FORMATION IN SOLID STATE REACTION
Fumihiko Saegusa Jun. 1971 33 p refs
(DA Proj. 1T0-621-5-A-328)
(AD-732488; WVT-7144) Avail: NTIS CSCL 20/2

Solid state reactions of cobalt oxide and aluminum oxide to form cobalt aluminate spinel at 1200-1400C were investigated by techniques of transmission electron micrography and thermogravimetry. Thin composite oxide films were used to study the nature and mechanism of the interface reactions. The

reaction kinetics between the equimolar amounts of mixed oxide powders were determined. The reaction rate was expressed by Jander's diffusion equation and was controlled by counterdiffusion of cobalt and aluminum ions. Comparison of theoretical and experimental values of diffusion coefficient in the spinel layer was discussed. Author (GRA)

N72-17836# California Univ., Riverside. Dept. of Physics.
TRANSPORT AND OPTICAL PROPERTIES OF LOW MOBILITY SOLIDS Final Report, 1 Aug. 1967 - 31 Aug. 1971
Robert L. Wild, Nai Li Huang Liv, and Donald C. McCollum 31 Aug. 1971 16 p refs
(Contract AF-AFOSR-523-67; AF Proj. 9763)
(AD-732943; AFOSR-71-2865TR) Avail: NTIS CSCL 20/12

The work has been an integrated experimental and theoretical investigation of various basic properties of low mobility solids. Some 29 unclassified scientific papers were sponsored by this grant. Experimental work was done on rare earth chalcogenides, transition metal oxides and sulfides. Theoretical efforts were divided between interpreting experimental results and independent work on energy transfer mechanisms, magnetic interactions and energy band calculations in solids. Author (GRA)

N72-17837# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH, 1971:2 Quarterly Technical Summary Report, 1 Feb. - 30 Apr. 1970
Alan L. McWhorter 9 Aug. 1971 63 p refs
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-732923; ESD-TR-71-145) Avail: NTIS CSCL 20/12

The report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 February through 30 April 1971. The topics covered are Solid State Device Research, Materials Research, Physics of Solids and Microelectronics. The Microsound work is sponsored by ABMDA and is reported under that program. Author (GRA)

N72-17838# Norges Tekniske Hoegskole, Trondheim. Div. of Physical Electronics.
WAVE PHENOMENA AND AMPLIFICATION IN PERIODIC SEMICONDUCTORS Final Technical Report, 1 Jul. 1970 - 30 Jun. 1971
Tore Wessel-Berg Jul. 1971 59 p refs
(Contract DAJA37-70-C-2646; DA Proj. 2O0-61102-B-31-F)
(AD-732941; ARDG(E)-E-1449) Avail: NTIS CSCL 20/12

The purpose of the work is to investigate parametric processes in semiconductors with a point of view of using such processes for amplification of microwave signals. The investigations have been concerned with wave periodic variations of some relevant parameter such as doping density. The first part of the report deals with a simplified description of the basic modes and their interactions. It is concluded that the simple model describes most of the relevant characteristics of the basic modes but is inadequate for evaluating the details of parametric interactions. In the latter part of the report a more refined model is used involving diffusion and velocity saturation effects. This part contains a thorough discussion of the mode properties under these more general conditions. Author (GRA)

N72-17839# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Physics.
CRITICAL MAGNETIC PROPERTIES OF EUROPIUM IRON GARNET
A. A. Stelmach, Elmer E. Anderson, Sigurds Arajs, and B. L. Tehan 1 Nov. 1971 32 p refs
(Contract N00014-70-A-0311-001)
(AD-732782; TR-2-71) Avail: NTIS CSCL 20/12

The critical magnetic properties of europium iron garnet (EuIG) have been studied in the vicinity of the Neel temperature. The sample used in this study was a single crystal grown by the flux method. Magnetic measurements were made by utilizing the kink-point method for a spherical specimen in conjunction with a vibrating sample magnetometer. The critical exponents beta, delta, and gamma were determined and compared with the scaling equation, beta (delta-1)=gamma. An analysis was made in order to confirm the scaling prediction that the reduced magnetic field has a functional form which is dependent only upon the reduced magnetization. A test of the validity of the value for the Neel temperature, obtained by plotting applied magnetic field as a function of break-point temperature, has been made by application of the Kouvel-Fisher method. Author (GRA)

N72-17840# Army Electronics Command, Fort Monmouth, N.J.
INTERACTION OF 10.6 MICRON RADIATION WITH CURRENT CARRIERS IN GERMANIUM Research and Development Technical Report
Michael E. Benanti and Harold Jacobs Aug. 1971 17 p refs
(DA Proj. 1S6-62705-A-056)
(AD-732832; ECOM-3475) Avail: NTIS CSCL 20/12

The absorption of 10.6 micrometer energy by excess carriers in germanium is used to study carrier profiles within the bulk of intrinsic material. Excess carriers are injected into blocks of germanium with dimensions in the millimeter range. The material is probed by a fine beam from a CO2 laser and the energy in the exit ray is measured to determine carrier absorption. Carrier density in the material is found to correspond to two distinct patterns. The absence of space charge and pronounced carrier recombination was noted. The determination of carrier cross section is discussed. Author (GRA)

N72-17359# California Univ., Santa Barbara. Dept. of Physics.
MACROSCOPIC QUANTUM PHASE COHERENCE IN SUPERFLUIDS, THEORY
D. J. Scalapino *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 195-201 refs Sponsored by AROD (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17360# Pennsylvania Univ., Philadelphia. Dept. of Physics.
THE JOSEPHSON EFFECT AS A BASIS FOR DETERMINATION OF FUNDAMENTAL CONSTANTS EXPERIMENT
D. N. Langenberg *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 203-212 refs Sponsored by NSF and ARPA (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17361# Yale Univ., New Haven, Conn. Dept. of Physics.
NOISE IN A JOSEPHSON JUNCTION
Patrick A. Lee and Marlan O. Scully (MIT) *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 213-217 refs Sponsored by AFOSR (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17362# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
PULL-IN EFFECT IN JOSEPHSON OSCILLATORS AND AN IMPROVED METHOD OF e/h DETERMINATION
V. Kose, H. Fack, F. Melchert, and H.-J. Schrader *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 219-222 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17364# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
MEASUREMENT OF 2e/h BY THE JOSEPHSON EFFECT
B. W. Petley and J. C. Gallop *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 227-229 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17365# Pennsylvania Univ., Philadelphia. Dept. of Physics.
PROGRESS TOWARD THE JOSEPHSON VOLTAGE STANDARD: A SUB-PART-PER-MILLION DETERMINATION OF 2e/h
T. F. Finnegan, A. Denenstein, and D. N. Langenberg *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 231-237 refs Sponsored by NSF and ARPA (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17366# California Univ., Irvine. Dept. of Physics.
MEASUREMENT OF (h/m sub e) USING ROTATING SUPERCONDUCTORS
W. H. Parker and M. B. Simmonds *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 243-248 refs Sponsored by NSF (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17367# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
INFLUENCE ON THE FUNDAMENTAL CONSTANTS OF A PRECISE MEASUREMENT OF THE JOSEPHSON EFFECT IN LIQUID HELIUM
B. M. Khorana and D. H. Douglass, Jr. *In* NBS Precision Meas. and Fundamental Constants Aug. 1971 p 249-250 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17376# Muenster Univ. (West Germany). Physikalisches Inst.
PRECISION LATTICE PARAMETER MEASUREMENT BY X-RAY INTERFEROMETRY
U. Bonse, E. teKaat, and P. Spieker *In* NBS Precision Meas. and Fundamental Constants Aug. 1972 p 291-295 refs (See N72-17330 08-14)
Avail: SOD $6.00 as C 13.10:343

N72-17619*# North Carolina Univ., Chapel Hill.
HEAVY ION PASSIVE DOSIMETRY WITH SILVER HALIDE SINGLE CRYSTALS
Charles B. Childs and Thomas A. Parnell *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 138-141 refs (See N72-17601 08-22)
(Contract NAS8-26601; Grant NGL-34-003-040; Contract ARPA SD-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20L

N72-17677*# Brookhaven National Lab., Upton, N.Y.
MICROSCOPIC OBSERVATIONS OF X-RAY AND GAMMA-RAY INDUCED DECOMPOSITION OF AMMONIUM PERCHLORATE CRYSTALS
P. J. Herley (Picatinny Arsenal) and P. W. Levy *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 584-594 refs Supported in part by Picatinny Arsenal and AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 20L

N72-17482# Holobeam, Inc., Paramus, N.J.
CATASTROPHIC SURFACE DAMAGE PRODUCED IN Ba2NaNb5O15 CRYSTALS DURING INTRACAVITY FREQUENCY DOUBLING
Robert Webb *In* NBS Damage in Laser Mater. Nov. 1971 p 98-103 refs (See N72-17470 08-16)
(Contract F33615-69-C-1841)
Avail: SOD $1.50 as C13.10:356

N72-17485# Bausch and Lomb, Inc., Rochester, N.Y.
RUBY LASER DAMAGE THRESHOLDS IN EVAPORATED THIN FILMS AND MULTILAYER COATINGS
A. Francis Turner *In* NBS Damage in Laser Mater. Nov. 1971 p 119-123 (See N72-17470 08-16)
(Contracts Nonr-4717; N00014-68-C-0190; ARPA Order 306)
Avail: SOD $1.50 as C13.10:356

N72-17486# University of Southern Calif., Los Angeles. Dept. of Physics.
INVESTIGATIONS TOWARD UNDERSTANDING THE PHYSICS OF LASER DAMAGE TO THIN DIELECTRIC FILMS
L. G. DeShazer and J. H. Parks *In* NBS Damage in Laser Mater. Nov. 1971 p 124-136 refs (See N72-17470 08-16)
(Contract F44620-71-C-0067; Grants AF-AFOSR-1622-69; AF AFOSR-2066-71)
Avail: SOD $1.50 as C13.10:356

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N72-17841*# Bell Aerospace Co., Buffalo, N.Y. Propulsion Systems and Components Directorate.
SHUTTLE APS PROPELLANT THERMAL CONDITIONER STUDY Final Report
William E. Pearson Dec. 1971 230 p refs
(Contract NAS9-12047)
(NASA-CR-115363; Rept-8665-950002) Avail: NTIS CSCL 21I

A study program was performed to allow selection of thermal conditioner assemblies for superheating O2 and H2 at supercritical pressures. The application was the auxiliary propulsion system (APS) for the space shuttle vehicle. The O2/H2 APS propellant feed system included propellant conditioners, of which the thermal conditioner assemblies were a part. Cryogens, pumped to pressures above critical, were directed to the thermal conditioner assembly included: (1) a gas generator assembly with ignition system and bipropellant valves, which burned superheated O2 and H2 at rich conditions; (2) a heat exchanger assembly for thermal conditioning of the cryogenic propellant; and (3) a dump nozzle for heat exchanger exhaust. Author

N72-17842# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.
PROJECT SQUID SEMIANNUAL PROGRESS REPORT, 1 APRIL - 30 SEPTEMBER 1971
J. L. Franklin, T. Adamson, J. Nielsen, V. Sandborn, W. Sadeh, A. McDonald, F. Carta, P. Libby, F. Williams, F. Fendell et al 1 Oct. 1971 94 p refs See also Semiannual Progress Rept. dated 1 Oct. 1970, AD-714236
(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. Squid)
(AD-732764) Avail: NTIS CSCL 21/5

Reports of progress during the past six months on the 18 research programs comprising Project SQUID are presented. The research programs fall into the areas of Fluid Mechanics, Atomic and Molecular Collisions, Combustion and Chemical Rate Processes, and Chemi-Ionization and Ion-Molecular Reactions. Project SQUID is a cooperative program of basic research related to jet propulsion. It is administered by Purdue University and sponsored by the Office of Naval Research. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N72-17843* Bell Aerosystems Co., Buffalo, N.Y.
INJECTION HEAD FOR DELIVERING LIQUID FUEL AND OXIDIZERS Patent
Martin G. Drexhage, inventor (to NASA) Issued 7 Sep. 1971 8 p Filed 24 Sep. 1969 Sponsored by NASA
(NASA-Case-NPO-10046; US-Patent-3,603,092; US-Patent-Appl-SN-860635; US-Patent-Class-60-258; US-Patent-Class-60-39.74) Avail: US Patent Office CSCL 21H

An injection head is described for delivering liquid fuel and oxidizers to the thrust chamber of a reaction engine. It is characterized by a number of circumferentially arranged sets of radially aligned inner and outer fuel injection orifices, each set having radially aligned oxidizer injection orifices. The orifice of each set is adapted to deliver a stream intersecting the streams from the other orifices of the set. The velocity of the fuel streams delivered from inner and outer fuel orifices causes part of the stream from the oxidizer injection orifice to mix with the stream from the outer orifice. This is deflected along the wall of the thrust chamber, establishing a fuel-rich, cooler burning region with optimal mixing elsewhere. The temperature within the regions adjacent to the wall of the thrust chamber is maintained at an operative level well below that experienced elsewhere in the thrust chamber. Official Gazette of the U.S. Patent Office

N72-17844*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA-EPA AUTOMOTIVE THERMAL REACTOR TECHNOLOGY PROGRAM Status Report
Charles P. Blankenship and Robert R. Hibbard Jan. 1972 39 p refs
(NASA-TM-X-68010; E-6787) Avail: NTIS CSCL 18I

The status of the NASA-EPA automotive thermal reactor technology program is summarized. This program is concerned primarily with materials evaluation, reactor design, and combustion kinetics. From engine dynamometer tests of candidate metals and coatings, two ferritic iron alloys (GE 1541 and Armco 18-SR) and a nickel-base alloy (Inconel 601) offer promise for reactor use. None of the coatings evaluated warrant further consideration. Development studies on a ceramic thermal reactor appear promising based on initial vehicle road tests. A chemical kinetic study has shown that gas temperatures of at least 900 K to 1000 K are required for the effective cleanup of carbon monoxide and hydrocarbons, but that higher temperatures require shorter combustion times and thus may permit smaller reactors. Author

N72-17845*# General Electric Co., Cincinnati, Ohio.
HIGHLY LOADED MULTI-STAGE FAN DRIVE TURBINE: PLAIN BLADE CONFIGURATION DESIGN
D. C. Evans and G. W. Wolfmeyer Washington NASA Feb. 1972 112 p refs
(Contract NAS3-14304)
(NASA-CR-1964; GE-R71-AEG-242) Avail: NTIS CSCL 21E

The constant-inside-diameter flowpath was scaled for testing in an existing turbine test facility. Blading detailed design is discussed, and design data are summarized. Predicted performance maps are presented. Steady-state stresses and vibratory behavior are discussed and the results of the mechanical design analysis are presented. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation, and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N72-17846 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE INTERACTION OF THE SOLAR WIND WITH OPTICALLY THIN ATMOSPHERES Ph.D. Thesis
Archer Sylvester Mitchell, Jr. 1970 123 p
Avail: Univ. Microfilms Order No. 70-21596

The reactive hydromagnetic equations are derived for flow situations in which the bulk velocity of the plasma is perpendicular to the magnetic field, accounting for the generation of ions in the flow. The one-dimensional solution to the equations is discussed, and is assumed to render zeroth order modifications in the flow, allowing first order perturbation solutions for the flow velocity and magnetic field. The result of this analysis was applied to models of lunar and comet atmospheres. Several dimensionless parameters were found to characterize the interaction effects. The relative abundances of solar wind constituents impinging on the lunar surface was evaluated and the extent to which the lunar atmosphere will modify the makeup of the surface flux was estimated. The character of the flow in the optically thin comet region is described and discussed. Dissert. Abstr.

N72-17847 Boston Univ., Mass.
AN INVESTIGATION OF THE GRAVITATIONAL INTERACTION OF ELECTROMAGNETIC RADIATION AND MATTER AS A CAUSE OF THE COSMOLOGICAL RED SHIFT Ph.D. Thesis
John Christopher Hegarty 1970 127 p
Avail: Univ. Microfilms Order No. 70-22367

The explanation of the cosmological red shift as a consequence of the gravitational interaction of the electromagnetic radiation and the matter of the universe is considered. The study of a class of solutions to the Einstein field equations is presented for null electromagnetic fields. In order to compare the active gravitational mass of electromagnetic radiation with that of a stationary particle, the problem of the decay of an initially stationary particle into two photons was studied and the gravitational consequences of the decay examined. Discussion of an investigation of the gravitational interaction of the photons and test particles is presented. The correct form of the linearized equations of motion is considered. Dissert. Abstr.

N72-17848 Catholic Univ. of America, Washington, D.C.
COSMIC BACKGROUND MEASUREMENTS IN THE FAR INFRARED Ph.D. Thesis
Kandiah Shivanandan 1970 177 p
Avail: Univ. Microfilms Order No. 70-21921

A complete liquid helium cooled telescope was designed to carry out rocket observations above the atmosphere. The far infrared detector used was n-type InSb suitably fabricated for flight. Calibrations were carried out using conventional infrared techniques at room temperature and in the flight telescopes assimilating cold environment. Of the materials tested for blackbody, black velvet seems to have a good emissivity in the far infrared. The experiment was successfully flown and the results indicated a background temperature cooresponding to an 8 K blackbody in the wavelength region of 0.4 mm to 1.3 mm. The flux measured was two orders of magnitude higher than the expected 2.7 K blackbody spectrum. Some theoretical implications of this excess infrared flux is discussed in relation to gamma ray and X-ray background observations. Dissert. Abstr.

N72-17849*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
THE MIT OSO-7 X-RAY EXPERIMENT. A FIVE COLOR

SURVEY OF THE POSITIONS AND TIME VARIATIONS OF COSMIC X-RAY SOURCES Final Report, Dec. 1967 - Nov. 1971

Richard S. Taylor and George W. Clark Nov. 1971 239 p
(Contract NAS5-11082)
(NASA-CR-122338) Avail: NTIS CSCL 03B

The all-sky, X-ray measurements are made in five broad energy bands from 0.5 to 60 keV with X-ray collimators of one and three degree FWHM response. Working with the onboard star sensor source locations may be determined to a precision of plus or minus 0.1 deg. The experiment is located in wheel compartment number three of the spacecraft. A time division logic system divides each wheel rotation into 256 data bins in each of which X-ray counts are accumulated over a 190 second interval. Measurement chain circuits include provision for both geometric and risetime anticoincidence. A detailed description of the instrument is included as is pertinent operating information. Author

N72-17850*# Translation Consultants, Ltd., Arlington, Va.
ELEMENTARY PARTICLES AND COSMIC RAYS: COLLECTION OF ARTICLES, NO. 2

A. M. Galper and A. K. Ponosov Washington NASA Feb. 1972 202 p refs Transl. into ENGLISH of the book "Elementarnyye Chastitsy i Kosmicheskiye Luchi: Sbornik Statey, Vypusk 2" Moscow, Atom Press, 1969
(Contract NASw-2038)
(NASA-TT-F-656; F-656) Avail: NTIS CSCL 03B

A collection of papers on the physics of cosmic rays and elementary particles, the greater part of which deals with descriptions of experimental work on cosmic rays and the use of accelerators, is presented. A number of articles are devoted to theoretical questions and experimental methodology. Questions concerning muons, electrons, photons, the existance of quarks and fireballs in cosmic rays, and the mechanisms of elementary particle interactions in accelerators, are reviewed. For individual titles, see N72-17851 through N72-17862.

N72-17851*# Translation Consultants, Ltd., Arlington, Va.
MEASUREMENT OF ELECTRON FLUXES AND GAMMA RAYS OF ENERGY GREATER THAN 100 MeV AT VARIOUS HEIGHTS IN THE ATMOSPHERE

V. A. Bezus, A. M. Galper, N. L. Grigorov, V. V. Dmitrenko, L. F. Kakinkin, V. G. Kirillov-Ugryumov, B. I. Luchkov, A. S. Melioranskiy, Yu. V. Ozerov, I. L. Rozental et al *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 1-2 refs (See N72-17850 08-29)
Avail: NTIS CSCL 03B

An experiment conducted from 1967 to 1968, using balloons to measure the intensities and energy spectra of electrons and gamma rays of a direct vertical flow, and the electrons of a return (albedo) flow is described. Author

N72-17852*# Translation Consultants, Ltd., Arlington, Va.
THE EXISTENCE AND DETECTION OF FIREBALLS

Ye. I. Daybog and I. L. Rozental *in its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 22-37 refs (See N72-17850 08-29)
Avail: NTIS CSCL 03B

A critical analysis of experimental evidence favoring the existence of fireballs is presented. Author

N72-17853*# Translation Consultants, Ltd., Arlington, Va.
THE INVESTIGATION OF CASCADE SHOWERS IN A HORIZONTAL FLUX OF COSMIC RAYS

V. V. Borog, V. G. Kirillov-Ugryumov, A. A. Petrukhin, V. K. Chernyatin, and V. V. Shestakov *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 38-46 refs (See N72-17850 08-29)
Avail: NTIS CSCL 03B

The investigation of the horizontal flux of cosmic rays is continued using an ionization calorimeter to record cascade showers. The results of the operation of the installation in the spring of 1968 are analyzed. Author

N72-17854*# Translation Consultants, Ltd., Arlington, Va.
PROSPECTS FOR THE INVESTIGATION OF HIGH ENERGY COSMIC MUONS

V. G. Kirillov-Ugryumov and A. A. Petrukhin *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 47-60 refs (See N72-17850 08-29)
Avail: NTIS CSCL 03B

Basic problems involved in future investigations of cosmic muons are reviewed. Particular attention is given to the possibility of establishing the percentage of K-mesons in terms of angular distribution of muons, and to the nuclear interaction of muons. Principal results obtained from investigations made of cosmic muons up to 1968, are included. Author

N72-17855*# Translation Consultants, Ltd., Arlington, Va.
AN EXPERIMENTAL SEARCH FOR HEAVY PARTICLES AT SEA LEVEL

A. M. Galper, V. A. Gomozov, V. G. Kirillov-Ugryumov, Yu. D. Kotov, and B. I. Luchkov *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 61-71 refs (See N72-17850 08-29)
Avail: NTIS CSCL 03B

A method for isolating heavy particles, the experimental installation used, and the first results of a search at sea level for heavy particles with unit charge are described. Author

N72-17856*# Translation Consultants, Ltd., Arlington, Va.
RESONANCES IN KAON ANTIKAON AND KAON LAMBDA HYPERON SYSTEMS

V. S. Demidov, V. G. Kirillov-Ugryumov, A. K. Ponosov, V. P. Protasov, and F. M. Sergeyev *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 72-94 refs (See N72-17850 08-29)
Avail: NTIS CSCL 03B

Investigations made of the decay of baryonic and mesonic resonances with zero strangeness to a pair of strange particles (kaon(0), Lambda hyperon or kaon(0) sub 1, kaon(0) sub 1) are discussed. The effective mass of the baryonic system is between 1.6 and 2.4 GeV, that of the mesonic system between 1.0 and 1.5 GeV. Author

N72-17857*# Translation Consultants, Ltd., Arlington, Va.
THE PRODUCTION OF AN OCTET OF PSEUDOSCALAR MESONS IN THE COULOMB FIELD OF A NUCLEUS AND THE CROSS SECTION OF THE PHOTOPRODUCTION OF MESONS BY MESONS

G. S. Iroshnikov and Yu. P. Nikitin *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 95-110 refs (See N72-17850 08-29)
Avail: NTIS CSCL 03B

The possibility of using information on the photoproduction of mesons by mesons based on data on the production of mesons in the Coulomb field of the nucleus is analyzed. The conclusion is that there is a real possibility of so doing if the model of the strong interactions used is valid within one order of magnitude. Author

N72-17858*# Translation Consultants, Ltd., Arlington, Va.
DETERMINATION OF THE LENGTH OF nn-SCATTERING IN EXPERIMENTS IN CAPTURING NEGATIVE MUONS WITH DEUTERONS c24

Yu. P. Nikitin *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 111-116 refs (See N72-17850 08-29)
Avail: NTIS CSCL 20H

The influence of the interaction of neutrons in the final state on the nature of the nuclear reaction is investigated. Author

N72-17859*# Translation Consultants, Ltd., Arlington, Va.
THE ABSORPTION OF POSITIVE AND NEGATIVE PIONS BY COMPLEX NUCLEI c24
A. I. Fesenko *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 117-127 refs (See N72-17850 08-29)
Avail: NTIS CSCL 20H

The theoretical and experimental work already done in connection with the mechanism involved in the capture of positive and negative pions by nuclei is reviewed. It is concluded that pertinent questions have not been answered and that further investigation is required. Author

N72-17860*# Translation Consultants, Ltd., Arlington, Va.
MEASUREMENT OF ELECTRON AND GAMMA-QUANTA ENERGIES IN HEAVY LIQUID BUBBLE CHAMBERS c24
A. T. Bederkin, V. S. Demidov, A. I. Ponosov, V. P. Protasov, and F. M. Sergeyev *In its* Elemantary Particles and Cosmic Rays, No. 2 Feb. 1972 p 128-154 refs (See N72-17850 08-29)
Avail: NTIS CSCL 20H

The various methods used to measure electron and gamma-Quanta energies in heavy liquid bubble chambers are analyzed. The experimental results obtained from these measurements are tabulated. Author

N72-17861*# Translation Consultants, Ltd., Arlington, Va.
DEVELOPMENT OF A METHOD FOR STUDYING ELECTRON TRACKS IN BUBBLE CHAMBERS WITH A HEAVY LIQUID AND STRONG PULSE MAGNETIC FIELDS c24
V. K. Makarin, N. N. Mukhin, A. S. Romantseva, I. A. Svetlolobov, M. M. Sulkovskaya, S. A. Chuyeva, and R. S. Shlyapnikov *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 155-169 refs (See N72-17850 08-29)
Avail: NTIS CSCL 20H

A method for studying electron tracks in a xenon bubble chamber that is similar to that developed earlier for studying heavy, charged particles, and based on measuring the area of a segment over a short, initial section of the track, is described. Author

N72-17862*# Translation Consultants, Ltd., Arlington, Va.
THE NOBLE GAS SCINTILLATION MECHANISM c14
B. A. Dolgoshein and B. U. Rodionov *In its* Elementary Particles and Cosmic Rays, No. 2 Feb. 1972 p 170-198 refs (See N72-17850 08-29)
Avail: NTIS CSCL 14B

The noble gas scintillation mechanism is analyzed. Previous studies are reviewed, the elementary processes taking place along the track of an ionizing particle are discussed and properties of gas scintillators are described. Author

N72-17863*# Colorado State Univ., Fort Collins. Dept of Atmospheric Science.
RADIATION MEASUREMENTS FROM POLAR AND GEOSYNCHRONOUS SATELLITES Annual Report, 1 Oct. 1970 - 30 Sep. 1971
Thomas H. VonderHaar Dec. 1971 30 p refs
(Grant NGR-06-002-102)
(NASA-CR-122330; AR-1) Avail: NTIS CSCL 03B

Measurements of the earth's radiation budget, its climatology and its interannual variation, are described briefly. In addition, preliminary results are given on ocean energy transports, specific large scale and local radiation budget anamolies, and studies of the separate radiation budgets of the atmosphere and ocean. Initial work in preparation for additional radiation budget measurements from EOS and ATS satellites is described. A radiation budget system simulation program and several smaller projects (including a radiance normalization technique) are also mentioned. First annual global maps of the earth's radiation budget as measured from Nimbus 3 are included. Author

N72-17864*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MULTIFARIOUS TEMPORAL VARIATIONS OF LOW ENERGY, RELATIVISTIC COSMIC RAY ELECTRONS
Frank B. McDonald, Thomas L. Cline, and George M. Simnett (Calif. Univ., Riverside) Jan. 1972 17 p refs Submitted for publication
(NASA-TM-X-65811; X-660-72-15) Avail: NTIS CSCL 03B

A detailed examination is made of the intensity variations of 3 - 12 MeV interplanetary electrons. The data used are from the cosmic ray experiment flown on the IMP solar minimum through to the onset of the present solar maximum (i.e., from December 1963 through August 1969). A morphology for the intensity changes is tentatively proposed which includes solar flare-associated events, solar co-rotating increases, Forbush decreases, and quiet-time increases, as well as the long term eleven-year variation. It is contended that the electron component observed both during quiescent times and during quiet-time increases are galactic in origin. The quiet-time increases represent a completely new phenomenon that appears to be unique to the low energy electron population. During a quiet-time increase the electron intensity is enhanced by a factor of 3 to 5 over a period of days, and, in general, these periods anti-correlate with low-energy solar particle events. Qualitatively, their amplitude diminishes with increasing solar activity. Author

N72-17865*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
QUIET-TIME ELECTRON INCREASES, A MEASURE OF CONDITIONS IN THE OUTER SOLAR SYSTEM
L. A. Fisk and M. VanHollebeke (ESRO) Jan. 1972 47 p refs Supersedes NASA-TM-X-65625, X-660-71-294; see N71-31195 Submitted for publication
(NASA-TM-X-65812; X-660-72-29) Avail: NTIS CSCL 03B

One possible explanation for quiet-time electron increases, increases in the intensity of 3-12 MeV interplanetary electrons that have been reported by McDonald, Cline and Simnett, is discussed. It is argued that the electrons in quiet-time increases are galactic in origin, but that the observed increases are not the result of any variation in the modulation of these particles in the inner solar system. It is suggested instead that quiet-time increases may occur when more electrons than normal penetrate a modulating region that lies far beyond the orbit of earth. The number of electrons penetrating this region may increase when field lines that have experienced an unusually large random walk in the photosphere are carried by the solar wind out to the region. As evidence for this increased random walk, it is shown that five solar rotations before most of the quiet-time increases there is an extended period when the amplitude of the diurnal anisotropy, as is measured by the Deep River neutron monitor, is relatively low. Five rotations delay time implies that the proposed modulating region lies at approximately 30 AU from the Sun, assuming that the average solar wind speed is constant over this distance at approximately 400 km/sec. Author

N72-17866*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HELIUM ABUNDANCE VARIATIONS
K. W. Ogilvie Jan. 1972 18 p refs Submitted for publication
(NASA-TM-X-65822; X-692-72-24) Avail: NTIS CSCL 03B

Using observations of the solar wind by Explorers 34 and 43, the relationship is confirmed between the relative abundance of helium n sub alpha/n sub p and the bulk speed U of the wind, recently described by Hirschberg, Asbridge and Robbins. Use of this relationship n sub alpha/n sub p = a(t)+bU allows the dependence of the relative abundance of helium upon solar activity to be separated from its bulk speed dependence. The proportion of helium in the solar wind at a given bulk speed is found to increase with increasing sunspot number, averaged over the period of observation. It is shown that the relationship between average relative abundance and temperature, deduced using the bulk speed - temperature relation, is consistent with the data. The relative abundance of helium is not found to increase with increasing solar wind flux. This confirms the result

of Hirschberg et al, and contradicts the theoretical prediction of Geiss. Author

N72-17867*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEW MEASUREMENTS OF THE GALACTIC RADIATION SPECTRUM BETWEEN 200 KHz AND 2.6 MHz
Larry W. Brown Feb. 1972 10 p
(NASA-TM-X-65820; X-693-72-16) Avail: NTIS CSCL 03B

The Goddard Space Flight Center radio astronomy experiment aboard the IMP-6 satellite has provided new data on the absolute spectrum of the galactic background radiation at frequencies between 0.2 and 2.6 MHz. The measurements have been obtained both in the terrestrial magnetosphere and in interplanetary space. One of the primary investigations was the measurement of the low frequency component of the galactic radiation. The main sources of error are considered to be the rms noise fluctuations of the receiver, the measurement of the dipole antenna impedance, and in the determination of the noise source used in the preflight calibration of the receiver system. Interstellar models are planned considering the ambient plasma. F.O.S.

N72-17868*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A HIGH SENSITIVITY SEARCH FOR X-RAYS FROM SUPERNOVA REMNANTS IN AQUILA
D. A. Schwartz, D. A. Bleach, E. A. Boldt, S. S. Holt, and P. J. Serlemitsos Feb. 1972 16 p refs Submitted for publication
(NASA-TM-X-65825; X-661-72-36) Avail: NTIS CSCL 03B

A high sensitivity scan of the galactic plane was performed to search for 2-20 keV X-rays from supernova remnants. The spectra of five X-ray sources detected between 44 deg and 31 deg longitude, of which only two might be associated with suggested supernova remnants, are reported on. Upper limits are presented for the 19 possible supernova remnants scanned in this survey. Author

N72-17869# California Univ., Berkeley. Lawrence Radiation Lab.
CONVECTIVE EVOLUTION OF LARGE AMPLITUDE ALFVEN WAVES IN THE SOLAR WIND Ph.D. Thesis
Blake R. Patterson 16 Aug. 1971 151 p refs
(Contract W-7405-eng-48)
(LBL-45) Avail: NTIS

The convective evolution of large-amplitude Alfven waves is studied propagating in a nonuniform, streaming plasma modeled after the solar wind. Observed large- and small-scale properties of the interplanetary medium are reviewed. An idealized solar wind model is developed that neglects solar rotation and has a radial magnetic field. NSA

N72-17870# Michigan Univ., Ann Arbor. Dept. of Astronomy.
RELATIONSHIPS BETWEEN SOLAR FLARES AND OTHER ASPECTS OF SOLAR ACTIVITY Final Report, 1 Oct. 1966 - 30 Sep. 1971
Orren C. Mohler Nov. 1971 11 p refs
(Contract N00014-67-A-0181-0001; NR Proj. 013-205; ORA Proj. 085980)
(AD-732469) Avail: NTIS CSCL 03/2

The document reviews a program directed towards a better understanding of the relationships between solar flares and other aspects of solar activity. The work under the contract is centered around three principal projects: (1) the relationship aspects of solar act between daily 2800 MHz flux and the number of flares per day; (2) reexamination of solar circumstances prior to each geomagnetic storm since 1955; and (3) systematic study of all centers of activity since 1955. All research conducted under the contract already has been reported through a series of Quarterly Reports. It is reviewed briefly in the body of this report and it is published in part in six articles in astronomical and geophysical journals. Author (GRA)

N72-17871# Applied Scientific Research Corp. of Thailand, Bangkok.
THE FINE STRUCTURE OF THE SOLAR CHROMOSPHERE Annual Report, 1 Apr. 1969 - 31 Mar. 1970
Rawi Bhavilai Aug. 1971 17 p refs
(Grant DA-CRD-AFE-S92-544-68-G102; DA Proj. 2M0-611-B-52-B; AF Proj. 9777)
(AD-730761; FE-344-2; AR-2) Avail: NTIS CSCL 03/2

The solar chromosphere at the limb and also on the disk is studied with the purpose of ascertaining its fine structure and the relation between the spicules and the dark and bright fine mottles on the disk. High resolution time-lapse photography of the sun are made using a 150 mm Coude: refractor in conjunction with the 1/2 Angstrom band-width Zeiss H-alpha filter set at different positions on the profile of the line. Good data of the chromosphere at the limb at different wavelength settings and also on the disk at plus or minus 0.75 Angstrom from the line center are obtained. The data contain information on the fine structures at the solar limb and also about the time development of the dark and bright fine mottles at plus or minus 0.75 Angstrom from the line center. Reduction of the data is in progress. Author (GRA)

N72-17872# Electro-Mechanical Research, Inc., Princeton, N.J.
ADDITIONAL WORK ON A TELEVISION CAMERA, DATA PREPROCESSOR SYSTEM AND AN OPTICAL SYSTEM FOR THE REAL-TIME SOLAR MAGNETOGRAPH PROGRAM Final Report, 1 Apr. - 20 Aug. 1971
B. J. Tucker 20 Aug. 1971 14 p
(Contract N00014-71-C-0263)
(AD-732769; POA-1990) Avail: NTIS CSCL 03/2

The report summarizes the work accomplished on a Television Camera and Data Preprocessor System developed under Contract N00014-69-C-0316 and an Optical System developed by the Naval Research Laboratory for the Real-Time Solar Magnetograph Program. Author (GRA)

N72-17614*# Boeing Co., Seattle, Wash.
GALACTIC COSMIC RAY HEAVY PRIMARY SECONDARY DOSES
M. C. Wilkinson and S. B. Curtis (Calif. Univ., Berkeley. Lawrence Radiation Lab.) *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 104-107 refs (See N72-17601 08-22)
(Contract NASw-1963)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17615*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
METHODS OF SPACE RADIATION DOSE ANALYSIS WITH APPLICATIONS TO MANNED SPACE SYSTEMS
R. W. Langley and M. P. Billings *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 108-116 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17624*# Air Force Weapons Lab., Kirtland AFB, N.Mex.
THE GEOMAGNETICALLY TRAPPED RADIATION ENVIRONMENT: A RADIOLOGICAL POINT OF VIEW
F. Eugene Holly *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 170-177 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17625*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
ARTIFICIAL PERTURBATIONS OF THE RADIATION BELTS
John B. Cladis *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 178-192 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17626*# Bell Telephone Labs., Inc., Murray Hill, N.J.
SOLAR FLARE PARTICLE RADIATION
L. J. Lanzerotti *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 193-208 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17627*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
THE CHEMICAL COMPOSITION AND ENERGY CONTENT OF THE ENERGETIC COSMIC RADIATION
C. J. Waddington *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 209-214 refs (See N72-17601 08-22)
(Contract N00014-67-A-0113-0021)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17628*# Naval Aerospace Medical Inst., Pensacola, Fla.
APOLLO MISSION EXPERIENCE
Herman J. Schaefer *In* NASA Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 215-219 Sponsored by NASA (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17641*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE RISK OF SOLAR PROTON EVENTS TO SPACE MISSIONS
Martin O. Burrell *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 310-323 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17642*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROBABLE SOLAR FLARE DOSES ENCOUNTERED ON AN INTERPLANETARY MISSION AS CALCULATED BY THE MCFLARE CODE
Gerald P. Lahti and Irving M. Karp *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 324-328 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17643*# Lockheed Electronics Co., Houston, Tex.
THE SIGNIFICANT SOLAR PROTON EVENTS IN 20TH SOLAR CYCLE FOR THE PERIOD OCTOBER 1964 TO MARCH 1970
W. Atwell *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 329-335 refs (See N72-17601 08-22)
(Contract NAS9-10950)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17644*# North American Rockwell Corp., Downey, Calif. Space Div.
TIME BEHAVIOR OF SOLAR FLARE PARTICLES TO 5 AU
J. W. Haffner *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 336-344 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17645*# McDonnell-Douglas Co., Huntington Beach, Calif.
SOLAR COSMIC RAY HAZARD TO INTERPLANETARY AND EARTH-ORBITAL SPACE TRAVEL
W. R. Yucker *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 345-355 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17646*# Air Force Weapons Lab., Kirtland AFB, N.Mex.
SHORT TERM PREDICTION OF E GREATER THAN OR EQUAL TO 10 MeV PROTON FLUXES FROM SOLAR FLARES
George A. Kuck *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 356-361 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17667*# California Univ., Irvine.
NEUTRONS PRODUCED BY KNOWN ENERGIES OF IONS ABUNDANT IN SPACE
William W. Wadman, III *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 520-522 refs Sponsored by AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17670*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
LOW-ENERGY PARTICLE RADIATION ENVIRONMENT AT SYNCHRONOUS ALTITUDE
E. G. Shelley and S. K. Lens *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 530-538 refs Supported in part by the Lockheed Independent Res. Program (See N72-17601 08-22)
(Contract NAS5-10392)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17671*# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
NATURAL VARIATIONS IN THE GEOMAGNETICALLY TRAPPED ELECTRON POPULATION
A. L. Vampola *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 539-547 refs (See N72-17601 08-22)
(Contract F04701-70-C-0059)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17673*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JUPITER RADIATION BELT ENGINEERING MODEL
Neil Divine *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 556-560 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17703*# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Physics.
FREQUENCY OF LIGHT-FLASHES INDUCED BY CERENKOV RADIATION FROM HEAVY COSMIC-RAY NUCLEI
Richard Madey and P. J. McNulty *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 757-766 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17704*# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Physics.
DIRECT STIMULATION OF THE RETINA BY THE METHOD OF VIRTUAL-QUANTA FOR HEAVY COSMIC-RAY NUCLEI
P. J. McNulty and Richard Madey *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radition in Space Jan. 1972 p 767-772 refs Sponsored by Res. Corp., AFCRL, and NAS-NRC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17706*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JUPITER RADIATION TEST LEVELS AND THEIR EXPECTED IMPACT ON AN ENCOUNTER MISSION
J. B. Barengoltz *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 781-784 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17720*# California Univ., Berkeley. Lawrence Radiation Lab.
AN EXPERIMENTAL MEASUREMENT OF GALACTIC COSMIC RADIATION DOSE IN CONVENTIONAL AIRCRAFT BETWEEN SAN FRANCISCO AND LONDON COMPARED TO THEORETICAL VALUES FOR CONVENTIONAL AND SUPERSONIC AIRCRAFT
Roger Wallace and Michael F. Boyer *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 884-893 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17723*# Atomic Energy Commission, New York. Health and Safety Lab.
EXPERIMENTAL DETERMINATION OF COSMIC RAY CHARGED PARTICLE INTENSITY PROFILES IN THE ATMOSPHERE
W. M. Lowder, P. D. Zraft, and H. L. Beck *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 908-913 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17724*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOME GAMMA-RAY SHIELDING MEASUREMENTS MADE AT ALTITUDES GREATER THAN 115000 FEET USING LARGE Ge(Li) DETECTORS
G. T. Chapman (ORNL, Oak Ridge, Tenn.), R. P. Cumby (ORNL, Oak Ridge, Tenn.), J. H. Gibbons (ORNL, Oak Ridge, Tenn.), R. L. Macklin (ORNL, Oak Ridge, Tenn.), and H. W. Parker *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 914-921 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17726*# Atomic Energy Commission, New York. Health and Safety Lab.
THE PHYSICAL THEORY OF ONE DIMENSIONAL GALACTIC COSMIC-RAY PROPAGATION IN THE ATMOSPHERE
Keran OBrien *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 926-941 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

N72-17731*# National Aeronautics and Space Administration. Manned Spacecraft Center, Langley Station, Va.
OBSERVATIONS OF COSMIC RAY INDUCED PHOSPHENES
P. K. Chapman, L. S. Pinsky, R. E. Benson, and T. F. Budinger (Calif. Univ., Berkeley) *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 1002-1006 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 03B

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N72-17873* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPARATUS FOR AUTOMATICALLY STABILIZING THE ATTITUDE OF A NONGUIDED VEHICLE Patent
Volker W. Harms, inventor (to NASA) Issued 7 Sep. 1971 6 p Filed 28 Apr. 1969
(NASA-Case-ARC-10134; US-Patent-3,603,532; US-Patent-Appl-SN-819898; US-Patent-Class-244-3.21) Avail: US Patent Office CSCL 16D

The attitude of a nonguided missile or vehicle can be stabilized with respect to its trajectory by a freely rotatable control surface, which is prevented from complete aligment with the incident airstream by a biasing spring. This results in causing any vehicle attitude deviation to provide a moment to the vehicle that rotates it toward the desired attitude in line with the trajectory. Rapid damping of the vehicle attitude is accomplished by lagging the control surface's rotational movement back to the stable position behind the rotational movement of the vehicle back to the desired attitude.
Official Gazette of the U.S. Patent Office

N72-17874*# Translation Consultants, Ltd., Arlington, Va.
ASTROMETRY AND ASTROPHYSICS. NO. 7: STUDY OF ERRORS AND THE ANALYSIS OF ASTROMETRICAL OBSERVATIONAL RESULTS
Ye. P. Fedorov, ed Washington NASA Feb. 1972 156 p refs Transl. into ENGLISH of the publ. "Astrometriya i Astrofizika, 7, Izucheniye oshibok i analiz rezul'tatov astrometricheskikh nablyudeniy" Kiev, Naukova Dumka, 1969
(Contract NASw-2038)
(NASA-TT-F-683) Avail: NTIS CSCL 03B

In this collection the problems of increasing the quality of astrometric observations and their processing are elucidated; instrumental errors are discussed, and design improvements to reduce them are included. A distinctive feature of the papers, devoted to the analysis of the observations, is the use of the methods of mathematical statistics to reveal hidden periodicities and rigorous estimates of the reliability of the results. Also the problems of determining zero points of the fundamental catalog are discussed in detail. For individual titles, see N72-17875 through N72-17886.

N72-17875*# Translation Consultants, Ltd., Arlington, Va.
ORIENTATION OF THE SYSTEMS OF FUNDAMENTAL CATALOGUES FROM OBSERVATIONS OF MAJOR AND MINOR PLANETS
D. P. Duma *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 1-46 refs (See N72-17874 08-30)
Avail: NTIS CSCL 03A

The conditions under which corrections to equinox and equator could be separated from corrections to the elements of the planet's and earth's orbits are discussed. The conclusion is that determination of the corrections of the catalog zero-points from observation of minor planets loses its advantage because of the complex correlations between the coefficients of the equations. Utilization of the stationary artificial earth's satellites is suggested as a possible method for the solution of the problem. Author

N72-17876*# Translation Consultants, Ltd., Arlington, Va.
GENERAL ANALYSIS OF THE RESULTS OF LATITUDE OBSERVATIONS WITH A DANJON ASTROLABE AT POLTAVA DURING 1961.0 - 1964.4
A. A. Slavinskaya *In its* Astrometry and Astrophys., No. 7 Feb.

1972 p 47-61 refs (See N72-17874 08-30)
Avail: NTIS CSCL 03A

For processing observations with the Danjon astrolabe at Poltava during the period of 1961.0 to 1964.4, moments of star transitions were calculated using FK3 positions, and 20s.47 as the constant of annual aberration. The corrections to be applied to latitudes for transition to the new aberration constant, 20s.496, are given. To decrease the systematic errors latitudes were smoothed by the chain method. The closing error proved to be 0s.137. The group corrections are given for transition from the FK3 system to the FK4. 124 normal latitude values were smoothed by the analytical method. The spectrum of errors was investigated by means of analyzing deviations of the normal latitudes from the smoothed ones. The value S sub c 0s.000110 was taken as a spectrum characteristic. The amplitude and phase of the annual z-term proved to be unstable. It was found that the latitude decreases from morining until midnight and then increases again. Author

N72-17877*# Translation Consultants, Ltd., Arlington, Va.
FREE DIURNAL NUTATION OF THE EARTH BASED ON OBSERVATIONS AT PULKOVO FROM 1915 TO 1928 c13
Ya. S. Yatskiv *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 62-78 refs (See N72-17874 08-30)
Avail: NTIS CSCL 03B

The possibility of studying free diurnal nutation of the earth using customary latitude observations is examined. The results of deriving the parameters of this nutation based on the observation of Pulkovo from 1915 to 1928 are given. The period of free diurnal nutation thus obtained is in a good agreement with a theoretical one. The essential changes of the amplitude and phase of the nutation are revealed. The average value of the amplitude for the series of observations under consideration equals to zero 0S.010. Author

N72-17878*# Translation Consultants, Ltd., Arlington, Va.
ON THE PROBLEM OF THE SMOOTHING OF CLOCK CORRECTIONS c19
A. N. Kuryanova *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 79-85 refs (See N72-17874 08-30)
Avail: NTIS CSCL 12A

An expression and a transfer function is found for a linear transformation operator used in smoothing clock corrections. The fluctuations with periods from 35 to 270 days are shown to contribute to both deviations of the observed corrections from the smoothed curve and to the smoothed curve itself. Author

N72-17879*# Translation Consultants, Ltd., Arlington, Va.
DETERMINATION OF THE CONSTANTS OF ROTATION OF THE MOON TAKING INTO ACCOUNT THE ERRORS IN THE COORDINATES IN THE CRATER MOSTING A
V. S. Kislyuk *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 86-89 refs (See N72-17874 08-30)
Avail: NTIS CSCL 03A

The values of the rotational constants of the moon and the errors of the crater Mosting A are presented. The values are examined in respect to the system of limb craters. Results indicate that values found for I and f show little difference from those found earlier. Author

N72-17880*# Translation Consultants, Ltd., Arlington, Va.
DETERMINATION OF CERTAIN INSTRUMENTAL CHARACTERISTICS OF THE ZTL-180 ZENITH-TELESCOPE OF THE POLTAVA OBSERVATORY c14
N. A. Popov, N. I. Panchenko, and A. T. Tsapova *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 90-100 refs (See N72-17874 08-30)
Avail: NTIS CSCL 14B

The basic instrumental characteristics of the Poltava Observatory ZTL-180 zenith-telescope are examine. Values of divisions of the Talcott levels, the scale value of the micrometer screw, the distances between horizontal hatching on the micrometer glass plate, and others investigated. As a result of the investigation, it was concluded that the temperature coefficient of these distances is very small. Author

N72-17881*# Translation Consultants, Ltd., Arlington, Va.
THEORY OF THE DETERMINATION OF TUBE FLEXURE WITH THE USE OF AUTOCOLLIMATION c32
A. S. Kharin *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 101-110 refs (See N72-17874 08-30)
Avail: NTIS CSCL 14B

The theoretical dependence between the angle of rotation of the flat mirror, rigidly fastened to the objective casing, and the bend angle of the objective end of the tube, is examined. On the basis of this dependence, the autocollimation angle is represented by a linear function of the bend angles of both ends of the tube. It enables the differential flexure of the tube to be determined by means of measuring the autocollimation angle by a flat mirror fastened before the objective glass and the bend angle of the eye-piece of the tube by a collimator placed in the cube. Author

N72-17882*# Translation Consultants, Ltd., Arlington, Va.
PHOTOEXPOSURE METER FOR PHOTOGRAPHIC RECORDING OF CIRCLE READINGS c14
A. M. Stafeyev and I. N. Nabokov *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 111-113 (See N72-17874 08-30)
Avail: NTIS CSCL 14E

A photoelectrical apparatus is suggested to be used for choosing exposure during photographing the meridian circle limb. Such an apparatus the photoexposimeter is described. Author

N72-17883*# Translation Consultants, Ltd., Arlington, Va.
INVESTIGATIONS OF THE PIVOTS OF THE MERIDIAN CIRCLE OF THE ODESSA ASTRONOMICAL OBSERVATORY c11
M. Yu. Volyanskaya and A. M. Stafeyev *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 114-118 refs (See N72-17874 08-30)
Avail: NTIS CSCL 14B

Results concerning the wear of pivots in the meridian circle installed at the Odessa Astronomical Observatory are presented. The tests were made in two instrument positions using a contact method. A lever with a probe and a photomicroscope was also used with the method. The irregularities of the pivot radii are found in 2.5 degrees. The values of collimation corrections are also presented. Author

N72-17884*# Translation Consultants, Ltd., Arlington, Va.
CHROMATIC CURVE OF THE OBJECTIVE OF THE AVR-2 c14
B. F. Sincheskul and V. N. Sincheskul *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 119-127 refs (See N72-17874 08-30)
Avail: NTIS CSCL 14B

The results of an investigation on chromatic aberrations of the refractor AVR-2 object-glass of the Poltava Observatory, are given. The chromatic aberration of position was investigated by three various methods: (a) according to the Hartman scheme with application of narrow-band interference filter; (b) by photos taken with diffraction grating; and (c) by photos with an objective prism. The combination of these methods enable a wide range of wave lengths to be investigated as well as to compare the results obtained by three methods different in principle. The chromatic difference of magnification was estimated by photos of wide pairs of stars with different spectral classes of pair components. Author

N72-17885*# Translation Consultants, Ltd., Arlington, Va.
DETERMINATION OF THE LATITUDE OF THE MAIN ASTRONOMICAL OBSERVATORY OF THE UKRAINIAN SSR ACADEMY OF SCIENCES (GOLOSEYEVO) c13

N. A. Vasilenko *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 128-135 refs (See N72-17874 08-30)
Avail: NTIS CSCL 08B

The determination of the longitude of the Goloseyevo Observatory is studied. The local time was determined from observation of star pairs on equal altitudes. The methods of observation and processing are described. Author

N72-17886*# Translation Consultants, Ltd., Arlington, Va.
DISCUSSION OF THE RESULTS OF LATITUDE OBSERVATIONS AT PULKOVO WITH THE ZTF-135 IN THE EXPANDED PROGRAM DURING 1955.0-1961.3 c31
L. D. Kostina *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 136-154 refs (See N72-17874 08-30)
Avail: NTIS CSCL 08B

An analysis is given of the six-year latitude observations with the Freiberg zenith-telescope ZTF-135. The observations were conducted according to an expanded program. A correction to the constant of aberration was derived from the latitude series under investigation, as well as correction to the scale values and its temperature coefficient, declinations and proper motions of the centers of the Talcott pairs. Errors of star declinations and their proper motions taken from different catalogues were considered in detail. The estimate is given of the accuracy of the latitude observations of Pulkovo with the ZTF-135 during 1955.0 to 1961.3. The curve of latitude variations and value of z-term are presented. Author

N72-17887*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL QUARTERLY TECHNICAL REVIEW, VOLUME 1, NO. 4
Jan. 1972 228 p refs
(Contract NAS7-100)
(NASA-CR-125376) Avail: NTIS CSCL 03C

Instrumentation and data processing techniques for space application are presented. These include antennas, masers, amplifiers, receivers, rocket nozzles, and data acquisition and tracking techniques. Problems of navigation, ionization potentials, random processes and statistical analysis, polymeric films, and the radiation belts of Jupiter are also considered. For individual titles, see N72-17888 through N72-17901.

N72-17888*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.
NONSTATIONARY ENVELOPE PROCESS AND FIRST EXCURSION PROBABILITY c19
J.-N. Yang *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 1-12 refs (See N72-17887 08-30)
Avail: NTIS CSCL 12A

A definition of the envelope of nonstationary random processes is proposed. The establishment of the envelope definition makes it possible to simulate the nonstationary random envelope directly. Envelope statistics, such as the density function, joint density function, moment function, and level crossing rate, which are relevent to analyses of catastrophic failure, fatigue, and crack propagation in structures, are derived. Applications of the envelope statistics to the prediction of structural reliability under random loadings are discussed in detail. Author

N72-17889*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Environmental Sciences Div.
NONEQUILIBRIUM IONIZATION MEASUREMENTS IN HYDROGEN-HELIUM MIXTURES c24
L. P. Leibowitz *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 13-18 ref (See N72-17887 08-30)
Avail: NTIS CSCL 20H

Time-resolved emission measurements of several atomic line and continuum radiation channels were made behind the incident shock wave of an electric arc shock tube. Test times and nonequilibrium ionization times were obtained for shock velocities up to 2.5 X 10,000 m/sec in a 0.2 H2 - 0.8 He gas mixture. The shock-heated test gas was found to be free from driver gas contamination, and the test times were adequate to achieve steady state conditions. An activation energy of 4 eV was obtained from the nonequilibrium ionization time measurements. Modifications of experimental technique to determine the effect of test gas impurity level on ionization time measurements are discussed. Author

N72-17890*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Environmental Sciences Div.
ON THE POSSIBILITY OF EARTH REENTRY SIMULATION OF SHALLOW ANGLE JUPITER ENTRY c31
A. D. McRonald *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 19-29 refs (See N72-17887 08-30)
Avail: NTIS CSCL 22C

Possible Earth reentry simulation of shallow-angle (3 to 30 deg) Jupiter entry was investigated in terms of four parameters of the bow shock layer ahead of a blunt vehicle: peak (equilibrium) temperature, peak pressure, peak inward radiative flux, and time-integrated radiative flux. It is shown that simulation ranging from fair to good can be achieved. Reentry is easiest (lowest Earth reentry speed) at steep Earth reentry, in the Earth entry speed range of 15 to 22 km/sec, for both the Jupiter nominal and cool atmospheres. Increased Earth speed is required, generally, for increasing Jupiter entry angle, and for increasing temperature, radiative flux, time-integrated flux and pressure, in that order. Author

N72-17891*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
MEASUREMENT OF THE POWER SPECTRAL DENSITY OF PHASE OF THE HYDROGEN MASER c16
A. Sward *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 30-33 refs (See N72-17887 08-30)
Avail: NTIS CSCL 20E

Hydrogen masers are being developed for the Deep Space Network as improved frequency standards, in order to achieve better timing accuracies, reduced Doppler residuals, and lower phase noise in the tracking system. Performance data for the masers are given in two forms: time domain performance, useful for analyzing time keeping systems and Doppler systems; and frequency domain performance, useful for analyzing tracking systems. Particular attention is given to frequency domain performance, as obtained from both time domain measurements and direct measurements. Author

N72-17892*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
REDUCTION OF NEAR-IN SIDELOBES USING PHASE REVERSAL APERTURE RINGS c07
W. F. Williams *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 34-42 ref (See N72-17887 08-30)
Avail: NTIS CSCL 17B

A technique is described for reducing near-in sidelobes in spacecraft antennas by cancellation. This technique takes a small portion of the radiation from the antenna aperture and generates the near-in lobes, which are then fed out of phase relative to the main signal. Results of sample cases indicate that the first three lobes can be nearly eliminated at a 40% reduction in aperture efficiency. Author

N72-17893*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
DEVELOPMENT OF A 20-W SOLID-STATE S-BAND POWER AMPLIFIER c09
A. G. vanderCapellen *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 43-48 (See N72-17887 08-30)
Avail: NTIS CSCL 09E

As an alternative to the use of traveling wave tube amplifiers in spacecraft with long life mission requirements, a solid state S band amplifier was developed. A solid state amplifier with an output of 20 W at 2295 MHz, a dc/RF

efficiency of 38%, and a gain of 27 dB was developed. The physical and electrical performance of the solid state amplifier are described. Author

N72-17894*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.

A MARKOV CHAIN TECHNIQUE FOR DETERMINING THE ACQUISITION BEHAVIOR OF A DIGITAL TRACKING LOOP

H. D. Chadwick *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 49-57 ref (See N72-17887 08-30)
Avail: NTIS CSCL 22C

An iterative procedure is presented for determining the acquisition behavior of discrete or digital implementations of a tracking loop. The technique is based on the theory of Markov chains and provides the cumulative probability of acquisition in the loop as a function of time in the presence of noise and a given set of initial condition probabilities. A digital second-order tracking loop to be used in the Viking command receiver for continuous tracking of the command subcarrier phase was analyzed using this technique, and the results agree closely with experimental data. Author

N72-17895*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.

BIAS AND SPREAD IN EXTREME VALUE THEORY MEASUREMENTS OF PROBABILITY OF ERROR **c07**

J. G. Smith *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 58-68 refs (See N72-17887 08-30)
Avail: NTIS CSCL 17B

Extreme value theory is examined to explain the cause of the bias and spread in performance of communications systems characterized by low bit rates and high data reliability requirements, for cases in which underlying noise is Gaussian or perturbed Gaussian. Experimental verification is presented and procedures that minimize these effects are suggested. Even under these conditions, however, extreme value theory test results are not particularly more significant than bit error rate tests. Author

N72-17896*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.

ON THE SELECTION OF AN OPTIMUM DESIGN POINT FOR PHASE-COHERENT RECEIVERS EMPLOYING BAND-PASS LIMITERS **c09**

M. K. Simon *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 69-77 refs (See N72-17887 08-30)
Avail: NTIS CSCL 09C

An attempt to improve the performance of coherent carrier systems is described, involving optimizing the design point based upon a given practical optimizing criterion. The single-channel system is treated in detail, and a brief discussion is given on how to extend the technique to a two-channel system. Author

N72-17897*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Project Engineering Div.

JUPITER TRAPPED RADIATION BELTS

A. J. Beck *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 78-88 refs (See N72-17887 08-30)
Avail: NTIS CSCL 03B

Previously developed models for trapped electron radiation belts and trapped proton radiation belts in the Jovian magnetosphere are described. The spatial distribution of flux and the L shell dependence of the characteristic energy are displayed for both models. Based on these models, the fluence accumulated by a Jupiter flyby spacecraft is given in terms of the equivalent 3-MeV fluence for electrons and the equivalent 20-MeV proton fluence. Finally, some impacts of these fluences on outer planet missions are described. Author

N72-17898*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.

NOZZLE EXHAUST PLUME BACKSCATTER EXPERIMENT USING THE JPL MOLSINK FACILITY **c33**

W. Simon *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 89-96 refs (See N72-17887 08-30)
Avail: NTIS CSCL 20M

Qualitative tests were made by injecting water through a rocket nozzle wall, and the droplet trajectories were observed photographically. These tests were conducted for nozzles in which boundary layer flow is significant. The tests indicated that both gases and particulate matter will be found in the region outside of the plume boundaries, and can be calculated using current analytical techniques. A test program is being conducted to measure the distribution of exhaust gases from small nozzles using an electron beam/photomultiplier system and a matrix of quartz crystal microbalances. Calibration tests, using simulated hydrazine exhaust product gas mixtures, were also conducted. The test program and results of the pumping calibration tests with hydrazine (simulated hydrazine exhaust products) are reported. Author

N72-17899*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.

NEW POLYMER SYSTEMS: CHAIN EXTENSION BY DIANHYDRIDES **c06**

R. A. Rhein and J. D. Ingham *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 97-103 refs (See N72-17887 08-30)
Avail: NTIS CSCL 07D

The results are presented for a systematic investigation on the use of anhydrides to prepare stable elastomeric materials for space use, under mild reaction conditions. The three anhydrides investigated were found to provide effective chain extension of hydroxy-terminated poly(alkylene oxides) and poly(butadienes). These were tetrahydrofuran tetracarboxylic dianhydride, pyromellitic dianhydride, and benzophenone tetracarboxylic diahydride. The most effective catalyst investigated was ferric acetylacetonate, which resulted in chain extension at 333 K (60 C). One feature of these anhydride reactants is that they are difunctional as anhydrides, but tetrafunctional if conditions are selected that lead to reaction of all carboxyl groups. Therefore, chain extension can be effected and then followed by crosslinking via the residual carboxyl groups. Author

N72-17900*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.

MARINER VENUS-MERCURY 1973 MIDCOURSE VELOCITY REQUIREMENTS AND DELIVERY ACCURACY

E. L. McKinley *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 104-115 refs (See N72-17887 08-30)
Avail: NTIS CSCL 22C

The primary mission is described, which consists of encounters with Venus and Mercury; (a second encounter with Mercury is also possible). The exptected navigation sequences were simulated with a Monte Carlo computer program for the purpose of determining midcourse correction velocity requirements and delivery accuracies. These simulations provide sensitivity in velocity requirements and delivery accuracies to error sources affecting the navigation process. The orbit determination capability at the final pre-Venus maneuver is shown to be the dominant contributor to the velocity requirements for the primary mission. Similarly, the orbit determination capability at the final pre-Mercury maneuver is shown to be the dominant contributor to the delivery accuracy at Mercury. Author

N72-17901*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.

APPLICATION OF NEW RADIO TRACKING DATA TYPES TO CRITICAL SPACECRAFT NAVIGATION PROBLEMS **c21**

V. J. Ondrasik and K. H. Rourke *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 116-132 refs (See N72-17887 08-30)
Avail: NTIS CSCL 17G

Earth-based radio tracking data types are considered, which

involve simultaneous or nearly simultaneous spacecraft tracking from widely separated tracking stations. These data types are conventional tracking instrumentation analogs of the very long baseline interferometry (VLBI) of radio astronomy-hence the name quasi-VLBI. A preliminary analysis of quasi-VLBI is presented using simplified tracking data models. The results of accuracy analyses are presented for a representative mission, Viking 1975. The results indicate that, contingent on projected tracking system accuracy, quasi-VLBI can be expected to significantly improve navigation performance over that expected from conventional tracking data types. Author

N72-17902*# Martin Marietta Corp., Denver, Colo. Aerospace Group.
SPACE TRAJECTORIES ERROR ANALYSIS (STEAP) PROGRAMS. VOLUME 1: ANALYTIC MANUAL, UPDATE
Dec. 1971 243 p refs
(Contract NAS5-11795)
(NASA-CR-122331) Avail: NTIS CSCL 22C

Manual revisions are presented for the modified and expanded STEAP series. The STEAP 2 is composed of three independent but related programs: NOMAL for the generation of n-body nominal trajectories performing a number of deterministic guidance events; ERRAN for the linear error analysis and generalized covariance analysis along specific targeted trajectories; and SIMUL for testing the mathematical models used in the navigation and guidance process. The analytic manual provides general problem description, formulation, and solution and the detailed analysis of subroutines. The programmers' manual gives descriptions of the overall structure of the programs as well as the computational flow and analysis of the individual subroutines. The user's manual provides information on the input and output quantities of the programs. These are updates to N69-36472 and N69-36473. N.E.N.

N72-17903*# Martin Marietta Corp., Denver, Colo. Aerospace Group.
SPACE TRAJECTORIES ERROR ANALYSIS (STEAP) PROGRAMS. VOLUME 2: PROGRAMMERS' MANUAL, UPDATE
Dec. 1971 419 p refs
(Contract NAS5-11873)
(NASA-CR-122332) Avail: NTIS HC $6.00/MF $0.95 CSCL 22C

For abstract, see N72-17902.

N72-17904*# Martin Marietta Corp., Denver, Colo. Aerospace Group.
SPACE TRAJECTORIES ERROR ANALYSIS (STEAP) PROGRAMS. VOLUME 3: USERS' MANUAL, UPDATE
Dec. 1971 168 p refs
(Contract NAS5-11873)
(NASA-CR-122333) Avail: NTIS CSCL 22C

For abstract, see N72-17902.

N72-17905*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPLICATION OF THE STEEPEST ASCENT OPTIMIZATION METHOD TO A REENTRY TRAJECTORY PROBLEM
Bobby G. Junkin 10 Dec. 1971 108 p refs
(NASA-TM-X-64636) Avail: NTIS CSCL 22C

The direct optimization method is presented in detail. Nominal values of the control variables are input parameters. Perturbations are introduced into the control variables and the resulting first order predictions of changes in the payoff, and constraint functions are then determined. Through a sequence of prescribed cycles, a trajectory is eventually obtained which is reasonably close to the optimum. The method is successfully applied to an Apollo three-dimensional reentry problem. The study of this Apollo application problem has resulted in the development of a highly flexible computer program that can be modified to consider other trajectory optimization problems. Author

N72-17906*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMP SERIES REPORT/BIBLIOGRAPHY
Joseph H. King Dec. 1971 247 p refs
(NASA-TM-X-68817; NSSDC-71-21) Avail: NTIS CSCL 22C

The main characteristics of the IMP spacecraft and experiments are considered and the scientific knowledge gained is presented in the form of abstracts of scientific papers using IMP data. Spacecraft characteristics, including temporal and spatial coverages, are presented followed by an annotated bibliography. Experiments conducted on all IMP's (including prelaunch IMP's H and J) are described. Figures are presented showing the time histories, through the end of 1970, of magnetic field, plasma, and energetic particle experiments. Author

N72-17907*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Theoretical Studies Branch.
GAMMA-RAY ABSORPTION FOR A BEAM MODEL OF THE CRAB NEBULA PULSAR NP0532
F. W. Stecker and S. Tsuruta (NAS-NRC) Dec. 1971 7 p refs Supersedes X-641-71-468; see N72-12843 Submitted for publication
(NASA-TM-X-65787; X-641-71-509) Avail: NTIS CSCL 03A

A model is discussed for determining gamma ray absorption from NP0532 by estimating the effect of beaming as indicated by the pulsations. The main absorption process is considered to be that of pair production in the intense photon field which occurs during the pulse. The results indicate that for this model, absorption does not occur below 10 GeV. F.O.S.

N72-17908*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SHOCK-METAMORPHIC EFFECTS IN THE LUNA-16 SOIL SAMPLE FROM MARE FECUNDITATIS
Bevan M. French Nov. 1971 50 p refs
(NASA-TM-X-65805; X-644-71-471) Avail: NTIS CSCL 03B

The results of intensive studies indicate that shock-metamorphic effects, characteristic of meteorite impact and virtually identical to those observed in Apollo samples, are common in fragments of the Luna-16 soil sample from Mare Fecunditatis. Two types of shock effects are present: (1) deformation and partial melting features in rock and mineral fragments (1-2 percent of fragments); and (2) heterogeneous glasses and glassy breccias produced by shock melting (70-80 percent of fragments). Shock effects were observed in pyroxene (deformation twin lamellae, multiple planar shock lamellae, extreme mosaicism, partial isotropization); in plagioclase (planar shock lamellae, complete isotropization to form maskelynite); and in basalt fragments (plagioclase isotropization, selective partial melting). The glasses exhibit several characteristics of shock melting, especially: (1) diversity in chemical composition; (2) association with shock mineral fragments and Ni-Fe spherules; and (3) heterogeneous schlieren and incipient fusion of mineral inclusions. Two types of source rocks are present in the Luna-16 sample; basaltic (85-90 percent) and feldspathic (10-15 percent). The basaltic rocks are predominant and generally occur as unshocked fragments, indicating that they form the bedrock underlying Mare Fecunditatis. Author

N72-17909*# National Aeronautics and Space Administration, Washington, D.C.
THE PLANET JUPITER (1970) Space Vehicle Design Criteria (Environment)
Neil Divine Dec. 1971 93 p refs
(NASA-SP-8069) Avail: NTIS CSCL 03B

Data obtained through 1970, some materials published during the first half of 1971, and conclusions of the Jupiter Radiation Belt Workshop held in July 1971 are presented. All the information on Jupiter was derived from data obtained at angular and spectral resolutions possible with Earth-based instrumentation or with sensors on aircraft, rockets, and balloons.

The observations were made primarily in the visible, near visible, infrared, and radio portions of the electromagnetic spectrum. The information was assessed for the potential effects of the Jovian environment on spacecraft performance. The assessment was done independently for the three types of missions under consideration and formulated for overall spacecraft as well as for subsystem design. Author

N72-17910*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF B6 STARS
Anne B. Underhill Jan. 1972 59 p refs
(NASA-TM-X-65823; X-670-72-26) Avail: NTIS CSCL 03A

A study of the spectra of zeta Draconis (B6 III), beta Sextantis (B6 V), and alpha Leonis (B7 V), was made from high dispersion spectrograms which cover the spectral region 3100 A to 6700 A and from OAO 2 spectral scans covering the spectral region 1100 A to 3600 A. Profiles, equivalent widths and central intensities of many lines in the spectrum of zeta Draconis are presented, as well as for the major lines of beta Sextantis. Alpha Leonis rotates too rapidly for these measurements to be made from high resolution spectrograms. Flux envelopes for zeta Draconis and alpha Leonis, from 1100 A to 6050 A, were derived from published spectrum scans and from new scans obtained with OAO 2. Estimates of the radii and masses of these single stars are presented. Author

N72-17911*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INFRARED SPECTROSCOPY EXPERIMENT ON MARINER 9: PRELIMINARY RESULTS
R. A. Hanel, B. J. Conrath, W. A. Hovis, V. G. Kunde, P. D. Lowman, J. C. Pearl, C. Prabhakara, B. Schlachman, and G. Levin (Biospherics, Inc.) Feb. 1972 12 p refs Submitted for publication
(NASA-TM-X-65826; X-620-72-40) Avail: NTIS CSCL 03A

The Mariner 9 infrared spectroscopy experiment has provided good quality spectra of many areas of Mars, predominantly in the Southern Hemisphere. Large portions of the thermal emission spectra are significantly affected by dust with a silicon oxide content approximately corresponding to that of an intermediate igneous rock, implying that Mars has undergone a substantial geochemical differentiation. Derived temperature profiles indicate a warm daytime upper atmosphere with a strong warming over the south polar cap. Atmospheric water vapor is clearly observed over the south polar area and less strongly over other regions. Author

N72-17912# National Environmental Satellite Center, Washington, D.C. Meteorological Satellite Lab.
ON REFERENCE LEVELS FOR DETERMINING HEIGHT PROFILES FROM SATELLITE-MEASURED TEMPERATURE PROFILES
Christopher M. Hayden Dec. 1971 18 p refs
(NOAA-TM-NESS-32) Avail: NTIS

Reference level procedures used for determining pressure-height profiles from Nimbus 4 SIRS-B (satellite infrared spectrometer) data are described and examined. It is shown that, in both operational and experimental procedures, the height values derived from SIRS-B soundings for 500, 300, and 200 mb are of little use for improving the height values of the operational 12-hr forecast. An experiment is described that investigates the effectiveness of a separate source, an upper troposphere reference level in combination with temperature sounders, to produce pressure-height profiles. Indications are that improvements are modest. Finally, an experiment is described in which the high spatial density of future sounders is simulated to obtain gradient information for use in statistical predictions of a reference height. Author

N72-17913# California Inst. of Tech., Pasadena.
HYDROGEN LINE AND CONTINUUM STUDY OF MAFFEI 2 BY RADIO INTERFEROMETRY
G. S. Shostak and J. Weliachew 1971 22 p refs
(Contract N00014-67-A-0094-0019)
(AD-730974; Rept-1971-11) Avail: NTIS CSCL 03/2

The suspected spiral galaxy Maffei 2 has been interferometrically observed in the 21 cm line and adjacent continuum using a north-south baseline having a fringe spacing of 6.5 arc min. Velocity resolution was 21 km/sec. Positions of the emission centroids at each velocity allowed determination of the orientation and dynamic parameters of the object and a lower limit to the total mass. The fractional hydrogen content of Maffei 2 is less than .005 D, where D is the distance in Mpc. The continuum source associated with it is shown to be extended. Author (GRA)

N72-17914# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
INTERFEROMETER POSITIONS OF EIGHTEEN OH EMISSION SOURCES
Ellen G. Hardebeck 1971 18 p refs
(Contract N00014-67-A-0094-0019; Grant NSF GP-25225)
(AD-730707; Rept-1971-13) Avail: NTIS CSCL 03/2

The two-element interferometer of the Owens Valley Radio Observatory was used to measure the positions of thirteen sources in the 1612 MHz line of OH. Five sources are associated with infrared emitters (IRC-10011, IRC-50137, Orion A, VX Sgr, and R Aql). The OH positions agree with the infrared or optical positions to within the errors of measurement (from plus or minus 5 to plus or minus arc seconds). Eight other sources that have similar OH spectra but have no detected infrared radiation were also measured. These new positions will make a search for the associated infrared objects more practical. In addition, positions were found for five main-line sources of interest. The OH source near NGC 2438 was found not to coincide with the planetary nebula. The new position for W75 (N) lies near a weak continuum source. Author (GRA)

N72-17915# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.
THE AEROELASTIC DIVERGENCE OF UNGUIDED MISSLES BY DYNAMICS ANALYSIS
Joe C. Waters and Gerald W. Rister 2 Apr. 1971 50 p refs
(DA Proj. 1T0-61101-A-91-A)
(AD-732477; RL-TR-71-10) Avail: NTIS CSCL 19/7

A method of determining aeroelastic divergence conditions by dynamic analysis for unguided missiles is presented in this report. A sample problem has been calculated and aeroelastic divergence parameters investigated. The computer program is included along with user instructions. Author (GRA)

N72-17916# Aerospace Corp., El Segundo, Calif. Lab. Operations.
MARS: A POSSIBLE DISCREPANCY BETWEEN THE RADIO SPECTRUM AND ELEMENTARY THEORY Progress Report, Jan. - Dec. 1970
Eugene E. Epstein 1 Oct. 1971 21 p refs
(Contract F04701-71-C-0172)
(AD-731762; TR-0172(2230-20)-2; SAMSO-TR-71-226) Avail: NTIS CSCL 03/2

The available observations of Mars have been assessed. The radio spectrum does not turn up at short wavelengths, as predicted by elementary theory, but appears to be flat or perhaps slightly convex. Ideas about the origin of the radio spectrum of Mars may require re-examination if accurate and precise short millimeter-wave observations in the future confirm the present spectrum. Author (GRA)

N72-17917# Aerospace Corp., El Segundo, Calif. Lab. Operations.
M17 AND TAURUS A: 3.4-MM CONTOUR MAPS AND INTEGRATED FLUXES, JANUARY 1966 - MARCH 1971
John W. Montgomery, Eugene E. Epstein, John P. Oliver, Michael W. Dworetsky, and William G. Fogarty 1 Oct. 1971

27 p refs
(Contract F04701-71-C-0172)
(AD-732225; TR-0172(2230-20)-3; SAMSO-TR-71-223) Avail: NTIS CSCL 03/2

Contour maps at 3.4-mm of M17 (the Omega Nebula) and Tau A (the Crab Nebula) yield total integrated fluxes of 300 (-50, -40) and 215 (-44, -34) x 10 to the minus 26th power w/sqm-Hz, respectively. These results are in agreement with the values predicted by extrapolating data obtained at longer wavelengths. The M17 result is consistent with a thermal origin for the radiation. The low signal-to-noise ratio results reported by others, which indicated anomalously high total fluxes for Tau A at millimeter wavelengths, are not confirmed. The 3.4-mm maps are consistent with maps made at longer wavelengths.
Author (GRA)

N72-17918# Texas Univ., Austin. Applied Mechanics Research Lab.
ON THE SOLUTION OF TWO-POINT BOUNDARY-VALUE PROBLEMS ASSOCIATED WITH SPACECRAFT TRAJECTORIES
David G. Hull Apr. 1971 25 p refs
(Grant AF-AFOSR-1744-69; AF Proj. 9749)
(AD-732924; AMRL-1031; AFOSR-71-2898TR) Avail: NTIS CSCL 22/3

The problem of calculating spacecraft trajectories between fixed points in a given time is approached through Hamilton's principle, and numerical optimization methods are used to extremize the integral of the Lagrangian. The conclusion derived from this analysis is that the iteration schemes obtained in this fashion are identical with standard iteration schemes applied to the differential equations, that is, Picard iteration and Newton iteration.
Author (GRA)

N72-17919# Bureau of Mines, Washington, D.C.
GRAVITY FLOW OF POWDER IN A LUNAR ENVIRONMENT. 1: PROPERTY DETERMINATION OF SIMULATED LUNAR SOIL
David E. Nicholson Jul. 1971 39 p refs
(PB-203654; BM-RI-7543) Avail: NTIS CSCL 03B

The report investigates the mechanical behavior of fine soils in a lunar environment in engineering gravity-flow bins. The ultrahigh vacuum, absence of moisture, and a lunar gravity one-sixth that of earth gravity represents a unique environment, both advantageous and detrimental to these systems. On earth, moisture and gases contained in powder masses can be responsible for complex descriptions of gravity flow. Their absence appear to simplify the lunar soil behavior. However, simulation of the lunar gravity and vacuum complicates the development of experimental data for designing bins. The properties of a dry soil powder, its behavior under one-dimensional compression, and its torsional and direct shearing strength under earth atmosphere are described.
Author (GRA)

N72-17606*# North American Rockwell Corp., Downey, Calif. Space Div.
EFFECTS OF RADIATION ENVIRONMENT ON REUSABLE NUCLEAR SHUTTLE SYSTEM
A. G. Lane *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 48-56 refs (See N72-17601 08-22)
(SD-71-299) Avail: NTIS HC $10.00/MF $0.95 CSCL 22C

N72-17634*# Aerojet Nuclear Systems Co., Sacramento, Calif.
RADIATION ENVIRONMENT FOR RENDEZVOUS AND DOCKING WITH NUCLEAR ROCKETS
D. R. Rogers, E. A. Warman, and B. A. Lindsey *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 257-263 Sponsored by NASA and AEC (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22A

N72-17635*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
RADIATION EXPOSURE TO THE ORBITING LUNAR STATION AND LUNAR SURFACE RELATED TO REUSABLE NUCLEAR SHUTTLE OPERATIONS
Paul I. Hutchinson *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 264-269 (See N72-17601 08-22)
(Contract NAS8-24715; NAS9-10969)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22A

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N72-17920*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRUCTURAL INTERACTION WITH CONTROL SYSTEMS Space Vehicle Design Criteria (Structures)
R. B. Noll (Aerospace Systems, Inc.) and J. Zvara (Aerospace Systems Inc.) Nov. 1971 56 p refs
(NASA-SP-8079) Avail: NTIS CSCL 22B

A monograph which assesses the state of the art of space vehicle design and development is presented. The monograph presents criteria and recommended practices for determining the structural data and a mathematical structural model of the vehicle needed for accurate prediction of structure and control-system interaction; for design to minimize undesirable interactions between the structure and the control system; and for determining techniques to achieve the maximum desirable interactions and associated structural design benefits. All space vehicles are treated, including launch vehicles, spacecraft, and entry vehicles. Important structural characteristics which affect the structural model used for structural and control-system interaction analysis are given.
Author

N72-17921*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS OF AN OGEE-WING SPACE SHUTTLE ORBITER CONCEPT AT A MACH NUMBER OF 2.01
Lawrence E. Putnam Washington Feb. 1972 31 p refs
(NASA-TM-X-2473; L-8084) Avail: NTIS CSCL 22B

An investigation has been made at a Mach number of 2.01 to determine the effects of a flared rudder on the aerodynamic characteristics of an ogee-wing space-shuttle orbiter configuration. Also investigated were the effects of an upper-aft fuselage fairing for the orbital maneuvering system, elevon deflections, and rudder deflection on the aerodynamic characteristics of the configuration.
Author

N72-17922*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF CONFIGURATION MODIFICATIONS ON THE LOW-SUBSONIC AERODYNAMIC CHARACTERISTICS OF A SPACE SHUTTLE ORBITER CONCEPT WITH A BLENDED DELTA WING-BODY
Delma C. Freeman, Jr. Washington Feb. 1972 62 p refs
(NASA-TM-X-2513; L-8093) Avail: NTIS CSCL 22B

An investigation of several configuration modifications to improve the subsonic stability and performance of a blended delta wing-body space shuttle-orbiter concept has been conducted in the Langley low-turbulence pressure tunnel. These modifications included variations in vertical-tail location and orientation, wing planform shape, and afterbody shape. The model was tested at a Reynolds number, based on body length, of 17 x one million, at

a Mack number of 0.25, and at angles of attack from about -4 deg to 22 deg. Author

N72-17923*# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
SHUTTLE SYSTEMS EVALUATION AND SELECTION. VOLUME 2: BRIEFING Mid-Term Briefing
15 Dec. 1971 122 p
(Contract NAS9-11160)
(NASA-CR-115385; MSC-03822-Vol-2-Rev; B35-43-30) Avail: NTIS CSCL 22B

A briefing outline for the space shuttle program is presented. Topics include: series burn, parallel burn, booster status, and system comparison and evaluation. F.O.S.

N72-17924*# Martin Marietta Corp., Denver, Colo.
SPACE SHUTTLE PROPULSION SYSTEMS ON-BOARD CHECKOUT AND MONITORING SYSTEM DEVELOPMENT STUDY Quarterly Progress Report, Oct. - Dec. 1971
Dec. 1971 178 p
(Contract NAS8-25619)
(NASA-CR-123499; MCR-70-274; CDRL-187-Rev-A) Avail: NTIS CSCL 22B

Investigations on the fundamental space shuttle propulsion systems program are reported, with emphasis on in-depth reviews of preliminary drafts of the guidelines. The guidelines will be used to incorporate the onboard checkout and monitoring function into the basic design of the propulsion systems and associated interfacing systems. The analysis of checkout and monitoring requirements of the Titan 3 L expandable booster propulsion systems was completed, and the techniques for accomplishing the checkout and monitoring functions were determined. Updating results of the basic study of propulsion system checkout and monitoring is continuing. Author

N72-17925*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
THE STABILITY OF MOTION OF SATELLITES WITH FLEXIBLE APPENDAGES
Leonard Meirovitch and Robert A. Calico Washington NASA Feb. 1972 94 p refs
(Grant NGR-36-004-042)
(NASA-CR-1978; Rept-732-1) Avail: NTIS CSCL 22C

The mathematical formulation associated with the problem of stability of motion of a satellite consisting of a main rigid body and three (or less) pairs of flexible rods is presented. The rods are capable of flexure in two orthogonal directions. Whereas the rotational motion of the body is described by generalized coordinates depending on time alone, the elastic displacements of the rods depend both on spatial position and time. Assuming no external torques, there exist motion integrals in the form of momentum integrals. These integrals can be regarded as constraint equations relating the system velocities, and used to reduce the number of variables describing the motion. The stability analysis has been carried out by means of an extension of the Liapunov direct method. Since the elastic vibrations result in energy dissipation, it is shown that the equilibrium position is asymptotically stable if the Hamiltonian is positive definite and unstable if it can take negative values in the neighborhood of the equilibrium. Determining the sign definiteness of the Hamiltonian is complicated by the fact that it contains spatial derivatives of the elastic displacements. Two methods are presented to cope with this problem. The first, the standard modal analysis in conjunction with series truncation, develops criteria in terms of infinite series associated with the natural modes and frequencies of the elastic rods. The second, the method of integral coordinates, yields closed-form stability criteria involving the system parameters, such as the body moments of inertia, the length and mass distribution of the rods, the lowest natural frequencies of the rods, and the satellite spin velocity. Author

N72-17926# Army Missile Command, Redstone Arsenal, Ala. Cost Analysis Div.
ENGINEERING CHANGE PROPOSALS
James L. Gossett and Riley W. Monroe May 1971 19 p refs
(AD-730758) Avail: NTIS CSCL 16/4

Engineering changes are alterations to the established configuration identification. The number of changes will be dependent upon such factors as readiness of the system for production and technological changes. Definitions for cost areas requiring consideration in determining the total cost of an engineering change proposal have been established. Author (GRA)

N72-17890*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Environmental Sciences Div.
ON THE POSSIBILITY OF EARTH REENTRY SIMULATION OF SHALLOW ANGLE JUPITER ENTRY
A. D. McRonald *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 19-29 refs (See N72-17887 08-30)
Avail: NTIS CSCL 22C

N72-17605*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
IMPACT OF RADIATION DOSE ON NUCLEAR SHUTTLE CONFIGURATION
C. A. Goetz and M. A. Billings *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 40-47 refs (See N72-17601 08-22)
(Contract NAS8-24714)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22B

N72-17607*# Aerojet Nuclear Co., Idaho Falls, Idaho.
RADIATION ANALYSIS OF VARIOUS VEHICLE AND PAYLOAD CONFIGURATIONS FOR THE REUSABLE NUCLEAR SHUTTLE
W. E. Preeg *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 58-64 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22B

N72-17633*# North American Rockwell Corp., Downey, Calif. Space Div.
THE INFLUENCE OF RADIATION SHIELDING ON REUSABLE NUCLEAR SHUTTLE DESIGN
T. M. Littman and D. Garcia *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 251-256 refs (See N72-17601 08-22)
(Contract NAS8-24975)
(SD-71-441) Avail: NTIS HC $10.00/MF $0.95 CSCL 22B

N72-17697*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IDENTIFICATION AND CONTROL OF SPACECRAFT RADIATION SOURCES OF INTERFERENCE TO X-RAY AND GAMMA-RAY EXPERIMENTS
Albert E. Metzger (JPL) and Jacob I. Trombka *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 714-722 refs Prepared in cooperation with JPL (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22B

N72-17702*# Martin Marietta Corp., Denver, Colo.
RADIATION PROBLEMS ASSOCIATED WITH SKYLAB
John E. Braly and Thomas R. Heaton *In* NASA, Washington Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 748-755 refs (See N72-17601 08-22)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22B

N72-17717*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NUCLEAR RADIATION ENVIRONMENT ANALYSIS FOR THERMOELECTRIC OUTER PLANET SPACECRAFT
H. S. Davis and E. F. Koprowski (ART Res. Corp.) *In its* Proc. of the Natl. Symp. on Nat. and Manmade Radiation in Space Jan. 1972 p 862-865 refs (See N72-17601 08-22)
(Contract NAS7-100)
Avail: NTIS HC $10.00/MF $0.95 CSCL 22B

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N72-17927# Aeronautical Research Labs., Melbourne (Australia).
COMMENTS ON CREEP DEFLECTIONS IN AIRCRAFT STRUCTURES
G. L. Belcher Apr. 1971 17 p refs
(ISBN-642-97693-7) Avail: NTIS

A survey of structural creep tests is presented including constant load-constant temperature tests, and tests conducted under variable conditions. Analyses of creep and thermal stress in structures at elevated temperatures are also included. F.O.S.

N72-17928*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRESS-CORROSION CRACKING IN METALS Space Vehicle Design Criteria (Structures)
Aug. 1971 42 p refs
(NASA-SP-8082) Avail: NTIS CSCL 20K

Criteria and recommended practices for preventing stress-corrosion cracking from impairing the structural integrity and flightworthiness of space vehicles are presented. The important variables affecting stress-corrosion cracking are considered to be the environment, including time and temperature; metal composition, and structure; and sustained tensile stress. For designing spacecraft structures that are free of stress-corrosion cracking for the service life of the vehicle the following rules apply: (1) identification and control of the environments to which the structure will be exposed during construction, storage, transportation, and use; (2) selection of alloy compositions and tempers which are resistant to stress-corrosion cracking in the identified environment; (3) control of fabrication and other processes which may introduce residual tensile stresses or damage the material; (4) limitation of the combined residual and applied tensile stresses to below the threshold stress level for the onset of cracking throughout the service life of the vehicle; and (5) establishment of a thorough inspection program. F.O.S.

N72-17929*# Astro Research Corp., Santa Barbara, Calif.
THERMALLY STABLE MACRO-COMPOSITE STRUCTURES Final Report
H. U. Schuerch Washington NASA Feb. 1972 22 p refs
(Contract NAS7-728)
(NASA-CR-1973; ARC-R-482) Avail: NTIS CSCL 20K

Studies and experiments on the use of bimetallic lattice structures for determining and controlling thermal expansion characteristics are discussed. Author

N72-17930*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVALUATION OF MASSLESS-SPRING MODELING OF SUSPENSION-LINE ELASTICITY DURING THE PARACHUTE UNFURLING PROCESS
Lamont R. Poole and Earle K. Huckins, III Washington Feb. 1972 30 p refs
(NASA-TN-D-6671; L-8097) Avail: NTIS CSCL 20K

A general theory on mathematical modeling of elastic parachute suspension lines during the unfurling process was developed. Massless-spring modeling of suspension-line elasticity was evaluated in detail. For this simple model, equations which govern the motion were developed and numerically integrated. The results were compared with flight test data. In most regions, agreement was satisfactory. However, poor agreement was obtained during periods of rapid fluctuations in line tension. Author

N72-17931# Lockheed Missiles and Space Co., Sunnyvale, Calif.
INVESTIGATION OF THE SHEAR STRENGTHS OF MARINE SEDIMENTS UTILIZING THE DIRECT SHEAR METHOD
F. Simpson Jan. 1972 35 p refs
(LMSC-D244610) Avail: NTIS

Direct shear tests were conducted on 30 cores from the center of the San Diego Trough and its upper slopes. Sediment samples obtained on the slopes of the trough vary from a silty sand in shallow water depths (140 m) to a silty clay at deeper water depths (323 m). Area sampled in the center of the trough was at a water depth of 1240 m and had a nearly flat bottom composed of clay silt sediment. Strength envelopes computed from direct shear test can be categorized into three distinct core groups; group A from the trough slopes and groups B and C from the center of the trough. The representative direct shear strength envelope for group A exhibited both the highest rate of shear strength increase with increasing normal load (28.4 deg) and the highest cohesion value (56gm/sq cm). The representative strength envelope for group B cores had the lowest slope and intercept (cohesion) value, 11.6 deg and 0 gram/sq cm respectively. Greatest variability in the measured direct shear strengths occurred in group A. Major differences in the representative strength envelopes of the three core groups appear primarily due to changes in sediment grain size distribution and water content between groups. Author

N72-17932*# Wisconsin Univ., Madison. Coll. of Engineering.
FATIGUE FAILURE OF MATERIALS UNDER BROAD BAND RANDOM VIBRATIONS
T. C. Huang and R. W. Lanz 5 Aug. 1971 36 p refs Backup document for AIAA Synoptic, "An Investigation of Fatigue Failure of Materials under Broad Band Random Vibrations" scheduled for publication in AIAA Journal in Jul. 1972
(Grant NGL-50-002-001)
(NASA-CR-125378) Avail: NTIS CSCL 20K

The fatigue life of material under multifactor influence of broad band random excitations has been investigated. Parameters which affect the fatigue life are postulated to be peak stress, variance of stress and the natural frequency of the system. Experimental data were processed by the hybrid computer. Based on the experimental results and regression analysis a best predicting model has been found. All values of the experimental fatigue lives are within the 95% confidence intervals of the predicting equation. Author

N72-17933# Aerojet Nuclear Co., Idaho Falls, Idaho.
THE EVALUATION OF FAILURE AND FAILURE RELATED DATA
W. E. Vesely Aug. 1971 37 p
(Contract AT(10-1)-1375)
(ANCR-1024) Avail: NTIS

Techniques for evaluating failure data are described which yield a wide range of significant results. The failure data need not be particularly accurate and can be quite indirect in form; trouble call reports, failure logs, maintenance histories and other such data sources generally suffice to give the required information. From these basic types of data sources, failure rates can be determined, wear-out and degradations can be uncovered, environments causing unwarranted failures can be detected, objective quantitative assessments can be made on repair and

maintenance effectiveness, and sub-par performers can be located. These results are determined by means of quantitative evaluations which allow the uncovering of deficiencies before they are obvious. The particular techniques are discussed and data requirements and practical applications are given. Computer programs are briefly discussed to show results of actual evaluations and to show the capability of automating the techniques. Author

N72-17934# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
TOFA: A CDC 6600 COMPUTER CODE FOR TORSIONAL FREQUENCY ANALYSIS
P. Y. Wong Aug. 1971 34 p ref
(AECL-3994) Avail: AEC Depository Libraries

The TOFA code is designed for studying torsional vibrations of a mechanical system. It is intended as a tool for design engineers to determine if a mechanical system is torsionally stable. An analysis of a rotor system, commonly used in coolant pumps of a commercial nuclear power reactor, is presented as an application. Author (NSA)

N72-17935# Illinois Univ., Urbana.
EFFECTS OF UNIAXIAL COMPRESSION ON THE THIRD ZONE FERMI SURFACE OF ALUMINUM
William Alexander Spurgeon Oct. 1971 94 p refs
(Contract AT(11-1)-1198)
(COO-1198-853) Avail: NTIS

The effects of uniaxial compression up to 40 kg/sq cm on the (110)-gamma and (010)-beta orbit cross sectional areas of the third zone Fermi surface of aluminum have been determined using a de Haas-van Alphen phase shift method. Both areas were found to increase under compression, the gamma-orbit area by 4.70 plus or minus .24 x 0.001% per kg/sq cm and the beta orbit area by 3.44 plus or minus .70 x 0.001% per kg/sq cm. Author

N72-17936# California Univ., Livermore. Lawrence Radiation Lab.
TORSION AND EXTENSION OF ELASTIC-PLASTIC CYLINDRICAL TUBES
Manuel Enrique Prado 16 Aug. 1971 83 p refs
(Contract W-7405-eng-48)
(UCRL-51096) Avail: NTIS

Thin tubular specimens of 6061-T6 aluminum were tested by superimposing a torsional load on a constant axial stress. The ratio of the shear stress to shear strain at the initiation of torque was plotted as a function of axial strain. This ratio was found to be constant and equal to the elastic modulus of rigidity. Tests in which neither the stress nor the strain was constant were also performed. It was found that at the point where the torsional load was superimposed the axial load decreased as the axial strain increased. Such unloading implies that the material is not completely time-independent. However, it was determined that shear strain was also constant so that torsional behavior was still uncoupled from the axial behavior. This work indicates that the incremental flow theories are well founded. Tests were also carried out in which axial and torsional loads were applied simultaneously. Author

N72-17937# North American Rockwell Corp., Los Angeles, Calif.
THE EARLY DETECTION OF FATIGUE DAMAGE Final Technical Report, 1 Jul. 1968 - 30 Jun. 1971
John F. Mooer, Schillings Tsang, and George Martin Sep. 1971 179 p refs
(Contract F33615-68-C-1706; ARPA Order 1244)
(AD-730348; NA-71-590) Avail: NTIS CSCL 20/11

The report is the final technical report for a program directed at the development of nondestructive test NDT methods for the detection of early fatigue and fracture damage in metals and alloys. The program is based on an interdisciplinary approach designed to interrelate the factors of early damage with measurable physical phenomena. The program initially concentrated on a comprehensive study of the existing knowledge of fatigue phenoma in metals, and the results of the study are described in terms of fatigue and fatigue-associated phenomena, metallurgical structure, effect of interrelating fatigue phenomena on physical properties, and the availability of appropriate measurement techniques and equipment. Next, the program developed a series of controlled fatigue experiments to quantitatively measure the fatigue effects in selected metal specimens. These tests also included a systematic metallographic evaluation to determine the actual depth and character of the surface layer affected by progressive fatigue, particularly in the early stages of fatigue. Finally, NDT methods were evaluated in terms of their potential detection and measurement capability of the observed fatigue-related effects and damage as determined by the study and fatigue evaluation tests. Author

N72-17938# Iowa Univ., Iowa City. Dept. of Mechanics and Hydraulics.
DECOUPLING OF LARGE DEFLECTION DYNAMIC EQUATIONS OF ELASTIC STRINGS
Shiang-yu Lee and William F. Ames Aug. 1971 20 p refs
(Contract DAAF03-69-C-0014; Proj. Themis)
(AD-729369; THEMIS-UI-35) Avail: NTIS CSCL 20/11

The set of coupled nonlinear partial differential equations governing the large amplitude motion of an elastic string is reduced to a decoupled second order equation and a first order equation through a comparative study of characteristic arguments. The resulting equations reveal linear and nonlinear properties not previously apparent. These equations are also easier to solve but care must be exercised to comply with physical reality, as the equations do not guarantee compatibility. Two examples are given to illustrate procedures for solving problems with the decoupled system. Author (GRA)

N72-17939# Iowa Univ., Iowa City. Dept. of Mechanics and Hydraulics.
A THEORY OF MODERATELY THICK STRUCTURAL ELEMENTS. PART 1: THICK BEAMS
Darrel D. Penrod and D. P. Singh Sep. 1971 29 p refs
(Contract DAAF03-69-C-0014; Proj. Themis)
(AD-731065; THEMIS-UI-38) Avail: NTIS CSCL 20/11

The report presents a theory of moderately thick plates and shells as it specifically applies to thick beams. The technique, based on a power series expansion of the displacement field about the middle surface, is applicable to any elastic body, but is directly applied to beams. An example problem is solved by the higher order techniques and compared with the Euler solution and the elasticity solution. The results were very close to the elasticity solution. This theory gives a workable beam theory for much smaller L/D ratios that Euler beam theory. Author

N72-17940# Aeronautical Research Inst. of Sweden, Stockholm.
MINIMUM WEIGHT DESIGN OF ORTHOTROPIC SANDWICH PANELS LOADED IN COMPRESSION AND SHEAR
Peter Stehlin and Lars Holsteinson Jan. 1971 75 p refs
(AD-732037; FAA-122) Avail: NTIS CSCL 13/13

The purpose of the report is the determination of the minimum weight configuration of rectangular orthotropic sandwich panels with fiber-reinforced plastic faces designed to meet specified requirements with regard to strength, stability, in-plane stiffness and minimum feasible thicknesses of core and faces. The design specifications are assumed to comprise an arbitrary number of different states of loading acting successively on the panel. Each state of loading may consist of either uniaxial compression or tension, pure shear, or a combination of such loads. In order to investigate the weight-efficiency of different reinforcing materials, optimum configurations are numerically determined for long sandwich panels with simply supported edges and with faces reinforced by bidirectional glass-fiber fabric, unwoven E-glass fibers and boron fibers. The weight of such panels is compared with that of panels having faces of aluminum

for the purpose of studying the advantages or disadvantages of aluminum and fiber-reinforced plastics as design materials in the light of different design requirements. Author

N72-17941# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
THEORY OF FATIGUE CRACK GROWTH BASED ON A BCS CRACK THEORY WITH WORK HARDENING
Johannes Weertman 1 Nov. 1971 26 p refs
(Contract N00014-67-A-0356-0016)
(AD-732493; TR-12) Avail: NTIS CSCL 20/11

The author's theory of fatigue crack growth, which is based on the Bilby, Cottrell, and Swinden crack theory, is modified to take into account work hardening at fatigue crack tips. In this analysis stress rather than cumulative displacement or cumulative damage is the quantity whose critical value controls the crack growth. The material at the tip of a fatigue crack progressively work hardens until the stress there reaches a critical value. The material then tears apart and the crack advances until it reaches a region in which the stress is smaller than the critical value. An equation which describes the growth of fatigue cracks is derived; it is essentially the same as the crack growth equation found in the earlier analysis. The major change is the replacement of the yield stress term in the older equation with an ultimate stress term in the newer equation. The chief change is the substitution for the average yield stress in the older equation with the ultimate stress in the present equation. Author (GRA)

N72-17942# Army Materials and Mechanics Research Center, Watertown, Mass.
FINITE ELEMENTS FOR DETERMINATION OF CRACK TIP ELASTIC STRESS INTENSITY FACTORS
Dennis M. Tracey Aug. 1971 23 p refs
(DA proj. 1T0-61102-B-32-A)
(AD-732837; AMMRC-TR-71-27) Avail: NTIS CSCL 20/11

In the report on finite elements for determination of crack-tip elastic stress intensity factors, a new type of finite element is introduced which embodies the inverse square root singularity present near a crack in an elastic medium. Using this element near the tip in two typical cracked configurations, stress intensity factors within five percent of accepted values were obtained with meshes having as few as 250 degrees of freedom. Author (GRA)

N72-17943# Catholic Univ. of America, Washington, D.C. Inst. of Ocean Science and Engineering.
ANALYSIS OF MULTI-WIRE STRANDS IN TENSION AND COMBINED TENSION AND TORSION
Michael Chi 1 Sep. 1971 29 p refs
(Contract N00014-68-A-0506-0001)
(AD-732006; Rept-71-9) Avail: NTIS CSCL 13/9

Geometrical relationship of a deformed and undeformed wire strand is derived through the use of differential geometry. In conjunction with balance laws of forces and moments, the governing equations for computing the strains, elongations and end-rotations of a strand with free or fixed ends and with tensile and torsional loadings are derived. The analytical results are compared favorably with the experimental data conducted on strands of steel and epoxy. Author (GRA)

N72-17944# Catholic Univ. of America, Washington, D.C. Inst. of Ocean Science and Engineering.
ANALYSIS OF OPERATING CHARACTERISTICS OF STRANDS IN TENSION ALLOWING END ROTATION
Michael Chi Sep. 1971 31 p refs
(Contract N00014-68-A-0506-0001)
(AD-732007; Rept-71-10) Avail: NTIS CSCL 13/9

A rational analysis of wire strand in tension is made through the use of exact geometrical relationship and theory of mechanics of materials. The calculated strains, deformations and end-rotations of a strand agree well with the experimental data. Effect of the end-rotation on the load distribution in the wires of a strand is shown in detail. It was also found that the gap between the core and helical wires had a surprisingly high effect on the load distribution in the wires and the amount of end-rotation. The present construction of strands is critically analyzed and possible improved design is indicated. Finally, a truly non-spinning strand design is presented on the basis of this new method of analysis. Author (GRA)

N72-17945# Illinois Univ., Chicago. Dept. of Materials Engineering.
A SIMPLE NUMERICAL SCHEME FOR THE DETERMINATION OF THE UNLOADING BOUNDARY Technical Report, 1 Jan. - 30 Jun. 1971
Albert B. Schultz Sep. 1971 19 p refs
(Contract F33615-71-C-1175; AF Proj. 7351)
(AD-732888; AFML-TR-71-199) Avail: NTIS CSCL 20/11

In several types of problems of one-dimensional stress wave propagation in an elastic-plastic material, unloading waves propagate and interact with loading waves at an unloading boundary. A simple, efficient numerical scheme is presented which may be used to compute the solution to problems of this kind. The scheme takes advantage of those general features of the solution which are known a priori. Author (GRA)

N72-17881*# Translation Consultants, Ltd., Arlington, Va.
THEORY OF THE DETERMINATION OF TUBE FLEXURE WITH THE USE OF AUTOCOLLIMATION
A. S. Kharin *In its* Astrometry and Astrophys., No. 7 Feb. 1972 p 101-110 refs (See N72-17874 08-30)
Avail: NTIS CSCL 14B

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N72-17946 Illinois Univ., Urbana.
THERMAL MODELING OF SPACECRAFTS Ph.D. Thesis
Joaquim Severino DepaivaNetto 1970 152 p
Avail: Univ. Microfilms Order No. 70-20949

The thermal modeling of multimaterial, two-dimensional systems for which the mode of heat transfer is by combined radiation and conduction was studied. An intuitive theory of modeling using imperfect models is proposed. When the errors in the various similarity parameters are not excessive, each has an independent effect on the dependent variable or variables in question. It is conjectured that the errors may be represented by a point in a multidimensional Eculidean space, called the error space. By assuming that the error path is approximated by a parabola, it is possible to deduce the required prediction from the data obtained with three imperfect models. The theory was applied to a hypothetical system, the configuration of which crudely simulated the global radiative and conductive paths of Mariner-type spacecraft. Dissert. Abstr.

N72-17947* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
STAND-OFF TYPE ABLATIVE HEAT SHIELD Patent
Caldwell C. Johnson, inventor (to NASA) Issued 7 Sep. 1971 4 p Filed 15 Jan. 1969
(NASA-Case-MSC-12143-1; US-Patent-3,603,260; US-Patent-Appl-SN-791268; US-Patent-Class-102-105; US-Patent-Class-244-117; US-Patent-Class-161-67) Avail: US Patent Office CSCL 20M

An ablative heat shield is described for protection against

aerodynamic heating of reentry spacecraft. It is made up of a carpet with pile extending from either side of a fabric base. One side of the carpet is impregnated with the standard ablative material, constituting the heat rejection element. The ends of the pile on the opposite side are adhesively bonded to the substructure of the spacecraft, so that the fabric base stands out from the substructure by the length of the pile.

Official Gazette of the U.S. Patent Office

N72-17948* Radio Corp. of America, Princeton, N.J.
RADIAL HEAT FLUX TRANSFORMER Patent
Robert J. Buzzard and Algerd Basiulis, inventors (to NASA) Issued 7 Sep. 1971 4 p Filed 3 Nov. 1969 Supersedes N70-35521 (08 - 19, p 3645) Sponsored by NASA
(NASA-Case-NPO-10828; US-Patent-3,603,382; US-Patent-Appl-SN-873260; US-Patent-Class-165-105) Avail: US Patent Office CSCL 20M

A radial heat flux transformer, adapted to be employed in the transfer of thermal energy, is described. The transformer is particularly suited for use in delivering energy radially and is characterized by two concentric cylinders interconnected by a network of groups of radially extended capillary channels with defined vapor spaces between them. A particular feature of the transformer is its capability of delivering vapor as well as its condensate in opposite radial directions between the concentric cylinders. The device may be employed interchangeably as a flux concentrator or a flux radiator.

Official Gazette of the U.S. Patent Office

N72-17949*# Dynamic Science, Irvine, Calif.
IGNITION OF FUEL VAPORS BENEATH TITANIUM AIRCRAFT SKINS EXPOSED TO LIGHTNING Final Report
T. C. Kosvic, N. L. Helgeson, and M. Gerstein Sep. 1971 110 p refs
(Contract NAS3-12009)
(NASA-CR-120827) Avail: NTIS CSCL 20M

Hot-spot and puncture ignition of fuel vapors by simulated lightning discharges was studied experimentally. The influences of skin coating, skin structure, discharge polarity, skin thickness, discharge current level, and current duration were measured and interpreted. Ignition thresholds are reported for titanium alloy constructed as sheets, sheets coated with sealants, and sandwich skins. Results indicated that the ignition threshold charge transfer for coated sheets, honeycomb, and truss skins is respectively about 200%, 400%, 800% that of bare alloy sheet of .102 cm (.040 in.)-thickness. It was found that hot-spot ignition can occur well after termination of the arc, and that sandwich materials allow ignition only if punctured. Author

N72-17950*# Advanced Technology Labs., Inc., Jericho, N.Y.
SOME EFFECTS OF SWIRL ON TURBULENT MIXING AND COMBUSTION
Arthur Rubel Washington NASA Feb. 1972 58 p refs
(Contract NASw-2075)
(NASA-CR-1956; ATL-TR-162) Avail: NTIS CSCL 20M

A general formulation of some effects of swirl on turbulent mixing is given. The basis for the analysis is that momentum transport is enhanced by turbulence resulting from rotational instability of the fluid field. An appropriate form for the turbulent eddy viscosity is obtained by mixing length type arguments. The result takes the form of a corrective factor that is a function of the swirl and acts to increase the eddy viscosity. The factor is based upon the initial mixing conditions implying that the rotational turbulence decays in a manner similar to that of free shear turbulence. Existing experimental data for free jet combustion are adequately matched by using the modifying factor to relate the effects of swirl on eddy viscosity. The model is extended and applied to the supersonic combustion of a ring jet of hydrogen injected into a constant area annular air stream. The computations demonstrate that swirling the flow could: (1) reduce the burning length by one half, (2) result in more uniform burning across the annulus width, and (3) open the possibility of optimization of the combustion characteristics by locating the fuel jet between the inner wall and center of the annulus width. Author

N72-17951*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW GRAVITY VENTING OF REFRIGERANT 11
Thomas L. Labus, John C. Aydelott, and Raymond F. Lacovic Washington Feb. 1972 28 p refs
(NASA-TM-X-2479; E-6590) Avail: NTIS CSCL 20M

An experimental investigation was conducted in a five-second zero gravity facility to examine the effects of venting initially saturated Refrigerant 11 from a cylindrical container (15-cm diameter) under reduced gravitational conditions. The system Bond numbers studied were 0 (weightlessness), 9 and 63; the liquid exhibited a nearly zero-degree contact angle on the container surface. During the venting process, both liquid-vapor interface and liquid bulk vaporization occurred. The temperature of the liquid in the immediate vicinity of the liquid-vapor interface was found to decrease during venting, while the liquid bulk temperature remained constant. Qualitative observations of the effects of system acceleration, vent rate, and vapor volume presented. Quantitative information concerning the ullage pressure decay during low gravity venting is also included. Author

N72-17952*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF THE FLOW, OXIDATION, COOLING, AND THERMAL-FATIGUE CHARACTERISTICS OF A LAMINATED POROUS SHEET MATERIAL
Robert O. Hickel, Edward L. Warren, and Albert Kaufman Washington Feb. 1972 51 p refs
(NASA-TN-D-6664; E-5872) Avail: NTIS CSCL 20M

The basic flow and oxidation characteristics of a laminated porous material (Lamilloy) are presented. The oxidation characteristics of Lamilloy are compared to a wireform-type porous material for the case when both materials are made from Hastelloy-X alloy. The cooling performance of an air cooled vane made from Lamilloy, as determined from cascade tests made at gas temperatures ranging from 1388 to 1741 C (2350 to 3165 F) is also discussed, as well as of a cascade-type thermal fatigue test of the Lamilloy vane. Author

N72-17953*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASURED PERFORMANCE OF A 1089 K (1500 DEG F) HEAT STORAGE DEVICE FOR SUN-SHADE ORBITAL MISSIONS
David Namkoong Washington Feb. 1972 71 p refs
(NASA-TN-D-6665; E-6511) Avail: NTIS CSCL 20M

Tubes designed for a solar heat receiver to serve as an energy source for a Brayton power system were tested for 2002 hours and 1251 sun-shade cycles. The tubes were designed to transfer a constant thermal input to the Brayton system during an orbit. Excess solar energy during a sun period is stored as heat of fusion of lithium fluoride. The niobium - 1% zirconium tubes accommodate the 23 percent volume decrease of LiF during freezing. Test results showed slight, local distortions. The gas discharge temperature varied from 16 K (29 F) below to 28 K(50 F) above the nominal value of 1089 K (1500 F). The tube surface temperatures ranged from 1039 K (1410 F) to 1183 K (1670 F). Author

N72-17954*# Fluidyne Engineering Corp., Minneapolis, Minn.
DEVELOPMENT OF A HIGH TEMPERATURE HEATER USING AN YTTRIA STABILIZED ZIRCONIA CORED BRICK MATRIX
Kenneth W. Smith and David G. Decoursin Oct. 1971 127 p refs
(Contract NAS2-2691)
(NASA-CR-114308; FluiDyne-0456) Avail: NTIS CSCL 20M

The Ames pilot heater is a ceramic regenerative heater that provides high temperature air for aerodynamic and combustion experiments. The development of this heater to provide a heat storage bed with temperature capability of about 4600 R is described. A bed was designed and installed having cored brick

elements of yttria-stabilized zirconia. The bed dimensions were 14 inches in diameter by 10 feet high. The thermal stress limitations of the bed were studied and maximum air flow rates based upon these limits were established. A combustion reheat system was designed and installed to provide the necessary control over the bed temperature distribution. The revised heater system was successfully operated at a maximum bed temperature of 4600 R. The successful operation demonstrated that yttria-stabilized zirconia cored brick can satisfy the high temperature-long duration requirement for storage heater applications. Author

N72-17955# Joint Publications Research Service, Washington, D.C.

EFFECT OF INHERENT HEAT CAPACITY OF THERMAL DETECTORS IN PULSE MEASUREMENTS

S. A. Drozdov, D. F. Salokhin, and G. G. Spirin 7 Feb. 1972 5 p refs Transl. into ENGLISH from Tepl. Vysokikh Temperatur (Moscow), v. 9, no. 6, Dec. 1971 p 1327-1329
(JPRS-55123) Avail: NTIS

For an estimate of the inherent heat capacity of the metal film of thermal detectors, the following model is considered. A plane metallic film of thickness t was placed at the interface of two nonconducting media, with thermophysical properties independent of temperature. The thermal effect of a rectangular current pulse through the film represents the effect of heat sources of intensity q/t distributed throughout its thickness. The case is considered for one media having a much lower thermal conductivity than the other. Heat flux into the medium with lower conductivity is assumed to be zero. The problem of heating a film, with internal heat sources, and with heat insulation on both sides, is solved. The asymptotic case for large values of time was also considered. K.P.D.

N72-17956# Joint Publications Research Service, Washington, D.C.

THERMODYNAMIC EFFICIENCY OF URANIUM-HEXAFLUORIDE MHD-PLANTS

I. I. Gutman, V. A. Dmitriyevskiy, and S. D. Tetelbaum 7 Feb. 1972 7 p refs Transl. into ENGLISH from Tepl. Vysokikh Temperatur (Moscow), v. 9, no. 6, Dec. 1971 p 1329-1331
(JPRS-55126) Avail: NTIS

The possibilities for using a gaseous nuclear fuel in a gas reactor and in magnetohydrodynamic plants are considered. The application of uranium hexafluoride is discussed as a nuclear fuel at temperatures providing for ionization of the pure uranium. Problems associated with radiation safety, materials for channels and electrodes, and reactor cooling are reviewed. K.P.D.

N72-17957# Illinois Inst. of Tech., Chicago. Dept. of Chemistry.

HIGH TEMPERATURE CHEMISTRY: FUNDAMENTALS OF EFFUSION AND THERMODYNAMICS OF MATERIALS Final Report, 1 Jun. 1961 - 31 Aug. 1971

Phillip G. Wahlbeck 31 Aug. 1971 130 p refs
(Contract AT(11-1)-1029)
(COO-1029-39) Avail: NTIS

A publication list of research completed under this contract is presented, and tentative results are given for research now in progress on the dissociation energy of ScSe, YSe, LaSe, and TiO. NSA

N72-17958# Los Alamos Scientific Lab., N.Mex.

SPACE ELECTRIC POWER R AND D PROGRAM, PART 1 Quarterly Status Report, period ending 31 Jul. 1971

Aug. 1971 5 p refs
(Contract W-7405-Eng-36)
(LA-4746) Avail: NTIS

Research and development progress is reported on heat pipe systems. Activities are summarized on tests of high-purity Li heat pipe, effects of impurities in heat pipes, and impurity removal methods. A method of constructing an in-pile test heat pipe is described. NSA

N72-17959# Kernforschungszentrum, Karlsruhe (West Germany).

EXPERIMENTAL STUDY OF INCIPIENT BOILING SUPERHEAT OF SODIUM ON ARTIFICIAL SURFACE ROUGHNESSES

G. F. Schultheiss Dec. 1970 113 p refs Transl. into ENGLISH from German report KFK-1332 Sponsored by US-Euratom Fast Reactor Exchange Program
(EURFNR-897; KFK-1332) Avail: NTIS

The surface materials used included stainless steel, pure nickel, iron, and chromium. Changes in surface roughness were achieved by cutting cylindrical cavities of varying depths and diameters into the surface materials. The results showed: little change in the surface cavities after long time boiling; that decreasing the depth-to-diameter ratio of the cavities slightly increases the incipient boiling superheat; the hot trap purified sodium experimental results are in good agreement with theoretical values of incipient boiling superheat calculated from the vapor pressure to surface tension equilibrium (critical radius of the nucleus equal to cavity radius); incipient boiling superheat depends on oxide concentration as well as on the test surface material; and for stainless steel, superheat has a typical maximum at about 127 C cold-trap temperature corresponding to 2 ppM Na_2O obviously caused by the chromium content. Pure iron and nickel did not show such maximum. Pure chromium behaves like stainless steel. Pure iron shows generally very small superheat not influenced by oxide concentration. NSA

N72-17960# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.

PACKAGE OF COMPUTER PROGRAMS FOR THE ANALYSIS OF TEMPERATURE DISTRIBUTION IN THREE DIMENSIONAL SYSTEMS

M. B. Carver Jul. 1971 38 p refs
(AECL-3783-Rev-1) Avail: AEC Depository Libraries; Atomic Energy of Can. Ltd., Chalk River: $1.00

TRUMP, a computer program for transient or steady state temperature calculations in complex systems calculates the temperatures in an interconnected series of nodes using an iterative heat balance scheme. The input data required to describe intricate geometry becomes very extensive and the preparation is time consuming. The programs described in this report have been developed to produce the various types of input required by TRUMP. Author

N72-17961# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering.

VAPOR COMPRESSIBILITY EFFECTS IN HEAT PIPES Final Report

Edward K. Levy 31 Aug. 1970 27 p refs
(Contract AT(30-1)-4095)
(NYO-4095-7) Avail: NTIS

Gasdynamic choking of the flow in the vapor passage of a heat pipe can place a limitation on the maximum rate of heat transfer, the sonic limit. The relation of the gasdynamic choking phenomenon to maximum heat transfer rates in sodium heat pipes, and the characteristics of incompressible laminar vapor flows within the condenser regions of heat pipes are studied. The results of these two studies are summarized. Author

N72-17962# Rensselaer Polytechnic Inst., Troy, N.Y.

STUDIES OF GAS-PARTICLE HEAT TRANSFER COEFFICIENTS IN PACKED AND FLUIDIZED BEDS BY FREQUENCY RESPONSE TECHNIQUES Final Report, 1 Jan. 1966 - 1 Sep. 1971

Howard Littman Aug. 1971 68 p refs
(Contract AT(30-1)-3639)
(RPI-3639-7) Avail: NTIS

A variety of fluid mechanical and heat transfer problems centered about the measurement and correlation of gas-particle heat transfer coefficients in packed and fluidized beds at low Reynolds numbers are discussed. Gas-particle heat transfer coefficients in packed beds at Reynolds numbers from 0.3 to

99.2 were measured and interpreted using a two phase three parameter model which accounts for interphase transfer, axial conduction in the solid phase, and dispersion in the gas phase. Supporting studies involving measurement of the static thermal conductivity of packed beds of copper and developments in the use of frequency response techniques are given. No model was found satisfactory for interpreting gas-particle heat transfer coefficients in fluidized beds. Author

N72-17963# Sandia Labs., Albuquerque, N.Mex.
CORRELATION OF EXPERIMENTAL CARBON AND GRAPHITE ABLATION DATA FOR REENTRY VEHICLE NOSE TIP APPLICATION
I. Auerbach, D. F. McVey, and D. D. McBride 1970 19 p refs Presented at the 9th AIAA Aerospace Sci. Meeting, N. Y. 25-27 Jan. 1971 Sponsored by AEC
(SC-DC-70-5104-A; Conf-710116-1) Avail: NTIS

An ablation parameter which would normalize environmental testing conditions would permit direct comparisons of ablation materials and testing facilities. An ablation parameter of this type is defined in terms of relationships which relate linear recession or mass loss data to model stagnation pressure and bulk gas enthalpy. Ablation data from AEDC, AVCO, and CAL were used to substantiate the relationships for 8 graphites and carbons. A statistical analysis of the parameter values showed that differences, if any, were much smaller than anticipated in 7 of the 8 materials tested. Author

N72-17964# Army Air Mobility Research and Development Lab., Fort Eustis, Va.
EXPERIMENTAL DETERMINATION OF THE IGNITION LIMITS OF JP-4 FUEL WHEN EXPOSED TO CALIBER .30 INCENDIARY PROJECTILES
Charles M. Pedriani Jul. 1971 34 p
(AD-730343; USAAMRDL-TR-71-48) Avail: NTIS CSCL 21/2

The report describes experimental efforts to define the ignition limits of JP-4 vapors subject to caliber .30 incendiary projectiles. A test fixture was fabricated which allowed a functioning incendiary projectile to pass through a known, uniform fuel/air vapor mixture. The resultant reaction was observed using high-speed photography. Ignitions between fuel/air ratios of 0.5 and 3.0 % JP-4 volume were observed. Additional tests were conducted to observe the flame suppression properties of reticulated polyurethane foam RPF and to determine that the impact flash from inert projectiles can ignite combustible fuel/air vapors. Author (GRA)

N72-17965# Raytheon Co., Bedford, Mass. Missile Systems Div.
THE AUGMENTATION OF FLOW BOILING HEAT TRANSFER IN TUBES (2) Final Report
Richard W. Murphy and F. E. Megerlin Jun. 1971 111 p refs
(Contract N62269-70-C-0363)
(AD-732464; BR-6518) Avail: NTIS CSCL 13/1

The study was oriented toward the fabrication and testing of improved repeatable, high-porosity turbulators for augmenting heat transfer in cylindrical tubes. It was found that the spiral brush insert was superior in repeatability, uniformity, and ease of emplacement to the other types (fiber-filled and knitted wire) considered. Experiments were performed to evaluate the effectiveness of spiral brush inserts in augmenting forced convection heat transfer at high fluxes with water as the fluid under both single-phase and subcooled boiling conditions. Based on equal Reynolds number, use of the spiral brush turbulators resulted in an eightfold increase in heat transfer coefficient over values achievable with comparable empty tubes. Judged on the same criterion, the burnout (critical) heat flux was raised by a factor of three using the spiral brush turbulators. On an equal-pumping-power basis, single-phase heat transfer performance was approximately equal for the two configurations. The results indicate that the spiral brush turbulator method of augmentation is highly advantageous in situations where high heat fluxes must be transferred while, at the same time, restrictions are imposed on available amounts of heat transfer area and coolant. Author (GRA)

N72-17966# Army Edgewood Arsenal, Md.
RADIATION TRANSFER BETWEEN FLAME BURNING ZONE AND UNBURNED FUEL Technical Report, Jun. 1970 - May 1971
C. Stuart Kelley Oct. 1971 81 p refs
(DA Proj. 1T0-61101-R-91-A)
(AD-732405; EA-TR-4555) Avail: NTIS CSCL 21/2

A fuel continues to burn by the heat returned from the flame to the unburned fuel. The heat transferred by radiation is dependent upon the intensities of the flame emission spectra, the fuel absorption, and especially on the overlap, or product, of the two spectra. The product of the two spectra was calculated point by point through the near infrared (2 microns to 6 microns) and integrated over wavelength for 14 fuels, primarily hydrocarbons. In general, maximum overlap occurs in the regions of CO2 and H2O emission bands. Overlap values vary from 3.19 x 10 to the -6th power for methane to 0.178 for unsymmetrical dimethylhydrazine. The overlap is shown to closely approximate the total radiation intensity absorbed by the fuel and is demonstrated to be linearly related to the fuel regression rate. Assumption of graybody absorption and emission are found to be poor approximations for those heat transfer processes. Methods are discussed for enhancing overlap and thereby the rate of energy release by the flame. Author (GRA)

N72-17967# Boston Coll., Chestnut Hill, Mass. Dept. of Chemistry.
STRUCTURE OF FLUORINE SUPPORTED FLAMES. 3: VIBRATIONAL DISEQUILIBRIUM OF PRESSURE H2-F2 FLAMES
Donald I. MacLean and George W. Tregay Oct. 1971 60 p refs
(Grant AF-AFOSR-1523-68; AF Proj. 9750)
(AD-732927; FRK-118; AFOSR-71-2670TR) Avail: NTIS CSCL 21/2

An experimental system has been designed and tested for the spectrophotometric study of low pressure fluorine supported flames. Fluorine gas flowrates of 5 to 500 cc/sec can be accurately measured and easily controlled. A multidiffusion burner and vacuum housing suitable for optical spectroscopic measurements is described. The continuously converting up to 40 cc/sec (at NTP) of gaseous F2 to CF4 with a total throughput of 25 l/sec. Low pressure hydrogen-fluorine flames diluted with argon have been stabilized under conditions suitable for measurement of both kinetic and relaxation processes. A total of 21 vibration-rotation bands of HF were observed. Temperature profiles of fluorine rich, lean and stoichiometric flames have been determined from the 3-0 emission band of HF. Author (GRA)

N72-17968# RAND Corp., Santa Monica, Calif.
CALCULATION OF GAS EXPANSION IN A RAREFIED ATMOSPHERE
Harold L. Brode and James E. Enstrom Mar. 1971 31 p refs
(AD-732636; P-4562) Avail: NTIS CSCL 19/4

Recent published similarity solutions for spherically and cylindrically symmetric gas expansions in rarefied atmospheres are extended to include the influence of ambient pressure. The former solutions and extended solutions are then compared with exact numerical calculations for the same gas expansions. Limits of applicability of each solution are discussed, and results compared with observations for typical barium gas release in the upper atmosphere. The extended similarity solutions have a range of validity up to an order of magnitude greater than that of the previous solutions. However, all of the similarity solutions are rendered inapplicable by the early onset of diffusion as the dominate expansion mechanism. Apparent agreement at later times is due to the similar growth rates for diffusion about t to the 0.5 power and similarity about t to the 0.4 power.
Author (GRA)

N72-17898*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.
NOZZLE EXHAUST PLUME BACKSCATTER EXPERIMENT USING THE JPL MOLSINK FACILITY
W. Simon *In its* JPL Quart. Tech. Rev., Vol. 1, No. 4 Jan. 1972 p 89-96 refs (See N72-17887 08-30)
Avail: NTIS CSCL 20M

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N72-17969*# Auburn Univ., Ala.
STARSITE: SEARCH TO ASSESS RESOURCES, SOCIAL, INSTITUTIONAL, TECHNICAL, AND ENVIRONMENTAL, TOWARD A DECISION-MAKING MECHANISM FOR HOUSING Final Report
Jan. 1972 402 p refs Prepared in cooperation with ASEE
(Grant NGT-01-003-044)
(NASA-CR-61371) Avail: NTIS HC $6.00/MF $0.95 CSCL 05C

The systems approach was used in the seminar on the complex multidisciplinary problem of housing and related environment conditions. The main areas of study are the following; historical overview of housing; diagrammatic presentation of the problem; technological innovations and contributions; management, economic, legal, and political considerations; environment and natural resources; human needs and behavior; model of the housing industry; and potential for implementation. It is felt that a greater attempt should be made to transfer aerospace technology to the housing industry; however, the emphasis of the conference was directed to the modern management techniques developed by NASA. Among the conclusions are the following: The extent and character of the housing problem should be defined. Increased coordination of housing programs within and between Federal agencies is essential. Development of physically sophisticated building systems requires Federal support. New towns of differing life styles need to be created. Physiological and psychological reactions to environmental enclosure need to be defined. N.E.N.

N72-17970*# Translation Consultants, Ltd., Arlington, Va.
INVESTIGATIONS OF THE UPPER ATMOSPHERE AND OUTER SPACE CONDUCTED IN 1970 IN THE USSR
M. I. Shtern, ed. Washington NASA Feb. 1972 166 p refs Transl. into ENGLISH of the book "Issledovaniyya Verkhney Atmosfery i Kosmicheskogo prostranstva, Vypolnennyye v SSSR v 1970 Gody" (Moscow, nauka Press, 1971 Presented at 14th meeting of COSPAR, Seattle
(Contract NASw-2038)
(NASA-TT-F-666) Avail: NTIS CSCL 04A

Short descriptions are given of the principal results of space investigations conducted during 1970. Significant events were: (1) Cosmonauts completed a long flight in the manned spacecraft Soyuz 9. (2) Luna-16 obtained a sample of lunar soil and delivered it to the earth. (3) Lunar-17 put the self-propelled vehicle Lunokhod 1 on the moon and the latter traveled the first kilometers on the lunar surface. (4) The interplanetary station Venera-7 landed on the surface of Venus. (5) Communications, television, and weather information satellites were launched. (6) The earth's atmosphere was studied, and medical and biological investigations were made. Author

N72-17971*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED CONCEPTS AND MISSIONS DIVISION PUBLICATIONS, 1971
Washington Dec. 1971 64 p refs
(NASA-TM-X-62105; M-71-1) Avail: NTIS CSCL 22A

This report is part of a series of annual papers on Advanced Concepts and Missions Division (ACMD) publications. It contains a bibliography and corresponding abstract of all papers presented or published by personnel of ACMD during the calendar year 1971. Also included are abstracts of final reports ACMD contracted studies perfomed during this time period. Author

N72-17972# Joint Publications Research Service, Washington, D.C.
COMPUTER USE IN MANAGING USSR INDUSTRY
N. Popov 8 Feb. 1971 11 p Transl. into ENGLISH from Planovoye Khoz. (Moscow), no. 12, Dec. 1971 p 74-79
(JPRS-55133) Avail: NTIS

Mathematical methods and modern computer techniques ensure rational movement of information flows, current processing of diverse information, optimization of controlling actions, a rise in the productivity of managerial labor by means of mechanization and automation of executive functions and technical operations, and also effective functioning of the systems of production control, comprehensively realizing the control of an aggregate of production processes. Author

N72-17973# Atomic Energy Commission, Washington, D.C. Library Branch.
SCIENCE AND SOCIETY. A BIBLIOGRAPHY
Hugh E. Voress, comp. Jul. 1971 21 p refs
(WASH-1182) Avail: NTIS

This bibliography has been computed to permit easy access to literature published in many places and in different forms. Major secondary sources used include Air Pollution Abstracts, Applied Science and Technology Index, Biological Abstracts, Chemical Abstracts, Books in Print, Index Medicus, Reader Guide to Periodical Literature, and Social Sciences and Humanities Index. A total of 410 references to all types of literature published during 1968 through March 1971 is included. The references are arranged by sensor author. A complete author index is provided. Author

N72-17974# Oak Ridge National Lab., Tenn.
APPROACH ATTAINING RESPONSIBLE ENGINEERING ACTION
M. Bender 14 Oct. 1971 11 p Presented at the 25th Ann. Quality Control Conf., Hartford, 14 Oct. 1971 Sponsored by AEC
(Conf-711023-1) Avail: NTIS

Engineering considerations wherein the effective end results of the whole effort determines the quality control requirements are presented. The engineering actions are controlled by this end result rather than the arbitrary boundaries of incremental portions of the engineering programs. Author

N72-17975# Atomic Energy Commission, Washington, D.C.
UNITED STATES ATOMIC ENERGY COMMISSION FINANCIAL REPORT, 1971
1971 64 p
(TID-25813) Avail: NTIS

The unclassified financial report of the Atomic Energy Commission for Fiscal Year 1971 is presented. The financial statements have been examined by the AEC internal audit staff and the auditors have found that, except for the exclusion of information relating to weapons and production inventories for security reasons, the statements fairly present the finacial position of AEC at June 30, 1971 and the results of operations for the year ended on that date. Author (NSA)

N72-17976# Atomic Energy Commission, Washington, D.C. Div. of Security.
US STATUTES OF GENERAL INTEREST TO SECURITY OFFICERS IN THE ATOMIC ENERGY PROGRAM

Ralph G. Mayer Jan. 1970 110 p
(TID-25833) Avail: SOD $1.00

The manual contains the presently pertinent contents of the August 1964 issue, including an update of sections of the Atomic Energy Act. The revisions in the manual include amendments of the Atomic Energy Act and the Internal Security Act as a result of Federal court decisions. The texts of laws are followed, where pertinent, by cross-references to texts of other statutes, and by comments on the application of such laws to the Atomic Energy program. Author

N72-17977# Army Aviation Systems Command, St. Louis, Mo.
DIRECTORATE OF SYSTEMS AND COST ANALYSIS: AIRCRAFT DESIGN OPTIMIZATION
Jack T. Markin Jun. 1971 17 p refs
(AD-730338; USAAVSCOM-TR-XS-71-4) Avail: NTIS CSCL 05/1

The performance and cost of an aircraft are related to its subsystem parameters. Parameter values are selected which require performance production at minimum cost. This method is also used for studying the effect on performance and cost of trade-offs between subsystems. GRA

N72-17978# Washington Univ., Seattle.
PLANNING TRANSPORTATION TERMINAL SYSTEMS IN URBAN REGIONS. A MAN-MACHINE INTERACTIVE PROBLEM SOLVING APPROACH
J. B. Schneider, John G. Symons, Jr., and Mark Goldman Apr. 1971 52 p refs
(Contract UMTA-URT-49(70))
(PB-202411; RR-5UMTA-URT-49-70-5) Avail: NTIS CSCL 15E

The location of transportation terminals in a large urban area is considered. A man-machine interactive system was developed and applied to a small test problem. The system permits the analyst to intuitively search a large combinatorial space in a conversational mode with the computer. The development of two computer heuristic search techniques is discussed, and experimental results showed that the techniques are quite powerful but not without weaknesses. Possible extensions and applications of the system are briefly discussed. Author (GRA)

N72-17979# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
[GENERAL PHYSICS, PLASMA DYNAMICS, AND COMMUNICATION SCIENCES AND ENGINEERING] Quarterly Progress Report
H. J. Zimmermann, G. G. Harvey, and S. J. Mason 15 Oct. 1971 197 p refs
(Contract DAAB07-71-C-0300)
(AD-732871; QPR-103) Avail: NTIS CSCL 20/8

Contents: Molecular beams; Microwave Spectroscopy; Radio Astronomy; Physical Electronics and Surface Physics; Electrodynamics of Media; Plasmas and Controlled Nuclear Fusion; Gaseous Electronics; Relativistic Beams; Speech Communication; Linguistics; Communications Biophysics; Signal Processing. Author GRA

N72-17980# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Materials Directorate.
A MATHEMATICAL ANALYSIS OF THE PROBLEM OF POINTING
C. D. Johnson Aug. 1971 28 p refs
(DA Proj. 1M2-62301-D-117)
(AD-732847; RL-TR-71-11; AMCMS-Code-522A.12.11300) Avail: NTIS CSCL 19/5

The report contains a mathematical analysis of the problem of automatically pointing a sighting device, mounted on a moving vehicle, at a fixed target. The results apply to situations such as automatic gunsights for helicopters, automatic camera aiming for airborne photography, etc. Basic mathematical relations, which govern all forms of such automatic pointing devices, are derived. Author (GRA)

N72-17981# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
LONG-LINE LOITER: PSYCHOLOGICAL WARFARE PACKAGE Final Report
Eric J. Jumper Jul. 1971 35 p refs
(AF Proj. 718405)
(AD-732891; AMRL-TR-71-85) Avail: NTIS CSCL 15/7

The report describes a long-Line delivered psychological warfare package. The package employs the circling-line phenomena to remotely broadcast from an altitude of 500 feet while the aircraft flies at 3,000 feet above the target. The equipment and techniques are discussed and the results of an intelligibility test are presented. Author (GRA)

N72-17982# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ANALYSIS OF DOD/NASA CONTRACTOR PROFITABILITY IN THE INCENTIVE CONTRACT ENVIRONMENT M.S. Thesis
Jerry Eldon Trimble Oct. 1971 103 p refs
(AD-732909; GSM/SM/71-12) Avail: NTIS CSCL 05/3

This research evaluates the results of the increased use of incentive-type contracts by the Department of Defense and the National Aeronautics and Space Administration. The efficiency and productivity resulting from the use of capital and labor resources by the defense and space firms are compared over a period of time with a group of similar firms having purely commercial business. The comparison is made with the financial indicators of returns on sales, equity capital and total assets, equity capital turnover, total assets turnover, and sales dollars per employee. GRA

N72-17983# Mitre Corp., McLean, Va.
A TECHNOLOGY ASSESSMENT METHODOLOGY. VOLUME 3: COMPUTERS-COMMUNICATIONS NETWORKS Final Report
Hugh V. Neill Jun. 1971 261 p refs 7 Vol.
(PB-202778-3; MTR-6009-3-Vol-3) Avail: NTIS CSCL 05A

The computer technology assessment study includes the development and illustration of technological assessment methodology and the investigation of certain salient segments of the general computer situation. The topics include: task definition; technology descriptions; state of society/universe assumptions, attributes, and conditions; relevant impact areas; initial impact analysis; action options and recommendation for future research and development program; and forecasts/projections, uncertainty and analysis of future impacts. Author (GRA)

N72-17984# Wisconsin Univ., Madison. Water Resources Center.
PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON DATA AND INSTRUMENTATION FOR WATER QUALITY MANAGEMENT
Dec. 1970 535 p refs Conf. held at Madison, Wis., 21-23 Jul. 1970
(OWRR Proj. A-99-WIS(13))
(PB-203150; W71-08550) Avail: NTIS HC $6.00/MF $0.95 CSCL 13B

The central theme of the symposium was to assess the benefits offered by advanced data collection, analysis and display systems toward the enhancement of the nation's environment. Under this framework, the symposium considered case studies where advanced systems were in operation and experience has been gained, and explored the results of recent research on several topics. Author (GRA)

N72-17985# Office of Science and Technology, Washington, D.C.
ROLE OF REMOTE SENSING IN DEVELOPING COUNTRIES

Glenn E. Schweitzer Jul. 1971 88 p refs
(PB-203309; TA/OST-71-3) Avail: NTIS CSCL 05C

Contents: remote sensing and international development; remote sensing technology and application to developing countries; game counting and evaluation by photography; and Smithsonian/agency for international development symposium on potential application of remote sensing to economics in developing countries. GRA

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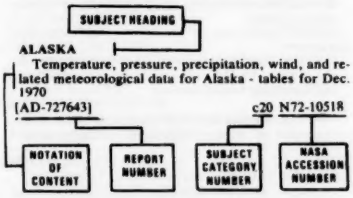

The subject heading is a key to the subject content of the document. The Notation of Content (NOC), rather than the title of the document, is used to provide a more exact description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The subject category number indicates the subject category in the abstract section in which the citation is located. The NASA accession number denotes the number by which the citation is identified within the subject category. The NOC's are arranged under each subject heading in ascending accession number order.

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[AD-732769] c29 N72-17872
Developmental study and guidelines for onboard checkout and monitoring system for space shuttle propulsion systems
[NASA-CR-123499] c31 N72-17924

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Method for determining presence and type of OH in MgO
[NASA-CASE-NPO-10774] c06 N72-17095
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Corrosive chemical reactions between stainless steels and various gases
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Mechanisms of airglow reaction NO plus O plus [M] yields NO2 plus [M] at low pressure, noting radiative and three body recombinations
c13 N72-17254

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Air pollution tests of plants exposed to gaseous hydrogen chloride
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Chlorine and air pollution studies, including emission sources, atmospheric interaction, measurement methods, and control methods - bibliographies
[PB-203355] c13 N72-17290

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[AD-732763] c06 N72-17105

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[NASA-CASE-ERC-10139] c09 N72-17154

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[NYO-4095-7] c33 N72-17961

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[AD-732780] c06 N72-17103

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[NASA-TM-X-2499] c17 N72-17501

CHROMIUM ALLOYS
Electrical and magnetic properties of amorphous chromium palladium silicon alloys containing small amounts of iron
[CALT-822-36] c18 N72-17545

CHROMIUM STEELS
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[NASA-TM-X-2496] c20 N72-17575

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Review of US civil aircraft accident data with related statistics on air carrier operations and safety records for year 1969
[PB-203183] c02 N72-17016
Supplemental issue of aircraft accident reports for calendar year 1969
[PB-202940] c02 N72-17017
Statistics on number of US civil aviation personnel based on certificates issued to pilots and nonpilots
[AD-732568] c05 N72-17090
Proposed method to automate operational functions concerned with nationwide monitoring of air traffic control system and control of air traffic flows
[AD-731722] c21 N72-17594

CLADDING
Nondestructive test evaluation of stainless steel clad tubing
[WARD-4210-T-3-7] c17 N72-17513
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Clear air turbulence observed using radar, pibal, and instrumented aircraft
[PB-202671] c13 N72-17292
Processing and analyzing clear air turbulence data collected by F-100, and F-106 aircraft
[AD-732878] c13 N72-17302
Wake and clear air turbulence, wind shear, upsets, thunderstorms, and turbulence mapping
[AD-732117] c20 N72-17579

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Hydrometeorological simulation by statistical analysis of climatological and meteorological data
[PB-202982] c20 N72-17582
Satellite observations of earth radiation budget and climatology
[NASA-CR-122330] c29 N72-17863

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Multilayered optical coatings that are black in visible portions of spectrum and white in infrared portions and remain stable during prolonged exposure to solar and ultraviolet radiation
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COBALT ALLOYS
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[PB-203665] c17 N72-17529
Ferromagnetic resonance measurements on rapidly quenched amorphous cobalt palladium silicon alloys
[CALT-822-38] c23 N72-17754

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COBALT 60
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c04 N72-17061
Response of cobalt 60 irradiated solar cells as function of atomic number of medium adjacent to cell and direction of gamma ray beam
c03 N72-17676
Application of cobalt and iridium isotopes for industrial radiography, radiation processing, and quality control
[A/CONF-49/P-539] c24 N72-17771

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[AD-732621] c14 N72-17445

CODING
ROD, nuclear and fuel-cycle analysis code, for circulating fuel reactors and optimizing core design
[ORNL-TM-3359] c22 N72-17737

COHERENT RADIATION
Proceedings of seminar on damage to laser materials to include summary of papers presented and recommendations based on information presented
c16 N72-17471
Analysis of damage mechanism related to laser glass materials exposed to high intensity laser pulses
c16 N72-17473
Photographic recording of time evolution of damage tracks in sapphire and ruby lens material due to laser radiation
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Effects of radiation from mode-locked and Q switched lasers on lithium niobate, proustite, and lithium iodate in nonlinear optical systems
[NASA-CR-125567] c18 N72-17481
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c26 N72-17486
Analysis of one shot laser induced damage to four typical anti-reflection coatings on fused silicon substrates
c18 N72-17487
Analysis of properties of mirror coatings used with high power carbon dioxide lasers during continuous wave and pulsed operation
c16 N72-17488
Bibliography of semiconductor lasers with theoretical and experimental studies of different lasing techniques
[AD-732700] c16 N72-17494
Coherent radiation, infrared laser physics, and superconducting tunnel junctions
[AD-732793] c16 N72-17496

COLD CATHODES
Electroluminescent reversed biased silicon carbide p-n diode as cold cathode emitter of hot electrons
[NASA-CR-111985] c09 N72-17159

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Collator simulation for determining transfer of training performance in males and females
[AD-730951] c05 N72-17086

COLLIMATORS
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c32 N72-17881

COLLISION PARAMETERS
Influence of collisions on localized instability caused by trapped electrons in toroidal configuration
[CEA-CONF-1800] c25 N72-17790

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Asymptotic behavior of one dimensional, two stream instability in collisionless plasma in electric field
[IPP-6/97] c12 N72-17210
Nonlinear interactions and turbulent whistler spectra in collisionless plasma
[AEC-TR-7275] c25 N72-17812
Flute instabilities in fully ionized, collisionless, low density plasmas in mirror machines
[UR-3942-11] c25 N72-17813
Development of linear microscopic theory of ion dynamics and waves in single-ended, collisionless Q machine plasmas
[FRNC-TH-66] c25 N72-17816

COLOR PHOTOGRAPHY
Evaluation of geographic patterns recorded on infrared color and color remote sensing imagery by waveforms and computer analysis
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COLOR TELEVISION
Color television system for allowing monochrome television camera to produce color pictures
[NASA-CASE-MSC-12146-1] c07 N72-17109

COMBINED STRESS
Development of finite life distributional Goodman diagrams and surfaces for determining allowable combinations of alternating stress and mean stress
[NASA-CR-120813] c15 N72-17456

COMBUSTION
Heat transfer between flame burning zone and unburned fuel
[AD-732405] c33 N72-17966

COMBUSTION PRODUCTS
Assessment of technological and nontechnological control strategies for reducing noxious automotive emissions
[PB-202778-2] c13 N72-17313
Air pollution data on sulfur dioxide, nitrogen dioxide, and suspended particulates for Cleveland area
[NASA-TM-X-2496] c20 N72-17575

COMMAND MODULES
Energy absorbing crew couch strut for Apollo command module
[NASA-CASE-MSC-12279] c15 N72-17450

COMMERCE
Computerized control in soviet industries and commerce
c08 N72-17139

COMMUNICATION
Signal energy transmission control in channel state feedback communication system
[PB-202780] c07 N72-17131
General physics, plasma dynamics, and communication sciences and engineering, including molecular beam, radio astronomy, and nuclear fusion studies
[AD-732871] c34 N72-17979

COMMUNICATION EQUIPMENT
Technical performance standards for radio communications-electronics equipment for improved frequency management
[PB-202822] c07 N72-17118

COMMUNICATION SATELLITES
System model and computer program for broadcasting satellite systems
[NASA-CR-122340] c07 N72-17111

COMPARATORS
Data acquisition study using automated photogrammetric systems with comparator and digital computer
[AD-732885] c13 N72-17304

COMPENSATORY TRACKING
Comparison of human eye controlled and hand controlled tracking tasks
[SC-RR-71-0502] c05 N72-17082

COMPLEX SYSTEMS
Computer programs for calculating transient or steady state temperatures in three dimensional systems
[AECL-3783-REV-1] c33 N72-17960

COMPLEX VARIABLES
Graphical plotting method for data analysis by multiple combinations of several variables applied to nuclear powered spacecraft heat shielding
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COMPOSITE MATERIALS
Vapor deposited materials on polyimide thin film substrates
[NASA-CR-1972] c18 N72-17537
Composite material as frequency filter in stress pulse propagation
[SC-DR-71-0472] c18 N72-17542
Impregnation and carbonization for densifying short, small diameter, carbon fibers into isotropic carbon-carbon composites
[Y-1784] c18 N72-17546
Fabrication of near-isotropic composites from discontinuous fibers and particulate coal tar pitch
[Y-DA-3953] c18 N72-17548
Physical and structural properties of mixed-modulus composite materials of graphite and S-glass fibers
[AD-732489] c18 N72-17549

COMPRESSORS
High temperature water jet compressor compared with lower discharge pressures
[PB-202753] c15 N72-17469

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Measurement of Compton wavelength of electron using bent crystal gamma diffraction spectrometer
c24 N72-17372
Compton wavelength determined by measuring wavelength of gamma radiation produced in two photon annihilation of positronium
c24 N72-17373
Characteristics of Compton scatter attenuation gamma ray spectrometer for performing gamma spectral measurements in monodirectional gamma fields
c14 N72-17681

COMPUTER GRAPHICS
Speech display simulation system for CDC 1604 computer
[COO-2118-0018] c08 N72-17144

COMPUTER PROGRAMMING
Developing center for computer-based behavioral studies for studying and analyzing national policies and problems
[AD-731859] c04 N72-17050
Asynchronous organizational operating units for simultaneously processing parts of computer program
[NYO-4209-14] c08 N72-17145
Queueing theory model of dynamic human behavior in time sharing computer system
[AD-732913] c08 N72-17148
Real time control of automobiles by computer analysis of visual images from television cameras
[AD-732644] c11 N72-17198
Determination of characteristics of air traffic control air/ground/air communications channel using nonreal-time simulation programming language
[AD-732619] c21 N72-17599
Primary mission description and simulation of navigation sequences using Monte Carlo computer program
c30 N72-17900

COMPUTER PROGRAMS
System model and computer program for broadcasting satellite systems
[NASA-CR-122340] c07 N72-17111
System interface requirements for Biomedical Laboratory computer system
[NASA-CR-115360] c08 N72-17136
Parallel algorithm for solving tridiagonal systems of linear equations by computer
[NASA-TM-X-62103] c08 N72-17137
Computer program for identifying parameters in linear systems with long intervals of observation
[NASA-CR-125573] c08 N72-17141
Analysis of techniques for translating theory of image enhancement to computer programs
[LA-DC-12840] c08 N72-17143
Speech display simulation system for CDC 1604 computer
[COO-2118-0018] c08 N72-17144
Computer program for optimal design of high voltage transmission grid
[HEDL-TME-71-108] c09 N72-17162
Flow charts, subroutines, and computer program for solving unified supersonic/hypersonic, small disturbance equations for flow around aircraft configurations
[NASA-CR-1927] c12 N72-17208
Evaluation of geographic patterns recorded on infrared color and color remote sensing imagery by waveforms and computer analysis
c13 N72-17234
Computer program of thermal modeling for interpretation of infrared images with application to earth resources
[PB-203578] c13 N72-17320
Computer program for determining optimum distribution of space radiation shielding on spacecraft geometry
c22 N72-17648
Computer code for analysis of gamma radiation penetration in laminated shielding
c22 N72-17651
Computer program for converting secondary gamma ray yield data into secondary production cross sections for reactor shielding design
c24 N72-17666
Monte Carlo computer program for determining gamma ray and neutron transport, and shield weight in complex geometries
c22 N72-17695
ANISN computer program for neutron capture, gamma ray spectrum calculations for materials for use in Cf-252 neutron activation facility
[ORNL-TM-3457] c24 N72-17766
Space Trajectories Error Analysis Programs [STEAP] - analytic manual update
[NASA-CR-122331] c30 N72-17902
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[NASA-CR-122332] c30 N72-17903
Space Trajectories Error Analysis Programs [STEAP] - users' manual update
[NASA-CR-122333] c30 N72-17904
Computer programs to determine fatigue life of material under multifactor influence of broad band random excitations
[NASA-CR-125378] c32 N72-17932
Computer programs for calculating transient or steady state temperatures in three dimensional systems
[AECL-3783-REV-1] c33 N72-17960

COMPUTER TECHNIQUES
Computer techniques for analyzing and correlating mass spectra of 32 alkyl aryl sulfides
[BM-RI-7604] c06 N72-17096
Computerized control and data processing systems in Soviet industry and research facilities
[JPRS-55047] c08 N72-17138
Computerized control in soviet industries and commerce
c08 N72-17139
Computerized data processing systems for scientific-engineering research facilitiy management
c08 N72-17140
Computer generated display system used as automated pronunciation instructor in English language learning
[AD-732231] c08 N72-17142
Monte Carlo computer technique for photocurrents and photoemission in irradiated material
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Computer technique for evolution study of phase-space distribution of electrons
c24 N72-17711
Mathematical methods and computer technology for managing USSR industry
[JPRS-55133] c34 N72-17972
Location of transportation terminals in urban area and two computer search techniques
[PB-202411] c34 N72-17978

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Computerized design of optimized radiation shielding for SNAP power systems
c22 N72-17608
Computer program for determining optimal thickness of asymmetric 4 pion radiation shielding design of space power reactor
c22 N72-17609

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Computerized simulation of speech displays from recorded speech input
[COO-2118-24] c08 N72-17146
Mathematical models for operational amplifiers for use in computer circuit analysis programs
[SC-RR-71-0628] c09 N72-17160
Computer simulation of high speed rain drop collision with rigid surface
[PB-203387] c12 N72-17229
Computerized simulation of weather sensitive military operation for developing appropriate weather services
[AD-732624] c20 N72-17585
Computerized simulation of solar flare radiation dosage received by shielded spacecrew during interplanetary flight
c29 N72-17642

COMPUTERS
Small computers for reducing Ge[Li] radiation spectra
c08 N72-17701

CONCORDE AIRCRAFT
Mass reduction of moderator and nucleon flux response for in-flight radiation warning system for SST
c14 N72-17719

CONDENSATES
Production of condensates from man occupied chambers and application to repeated cultivation of plants
c04 N72-17078

CONDUCTIVE HEAT TRANSFER
Models for heat transfer by combined radiation and conduction
c33 N72-17946

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Measurement and calibrating standards for correction of conductor and junction effects in network analysis
[SC-T-71-3067] c10 N72-17177

CONFERENCES
Conference on mesospheric models, Frascati, Italy, Jul. 1970
[LC-70-154737] c13 N72-17235
Modern techniques of precision measurement and application to determination of fundamental constants - conference
[NBS-SP-343] c14 N72-17330
Proceedings of symposium on damage in laser materials conducted by National Bureau of Standards at Boulder, Colorado, May 19 and 20, 1971
[NBS-SP-356] c16 N72-17470
Conference on radiation effects in manned space flight considering extraterrestrial radiation, nuclear rocket engines, radiation shielding, dosimeters, and radiobiology
[NASA-TM-X-2440] c22 N72-17601

CONICAL BODIES
Wind tunnel tests to determine flow distribution around cone model and supporting sting at hypersonic speed
[AD-732890] c01 N72-17002

CONSTANTS
Modern techniques of precision measurement and application to determination of fundamental constants - conference
[NBS-SP-343] c14 N72-17330
Determination of Avogadro number using optical and X ray interferometry
[NASA-TM-X-67529] c14 N72-17375
Compromise method for probability estimation of error in fundamental constant determination
c14 N72-17409

CONSTRUCTION MATERIALS
Interactions between glovebox construction materials and fluorine gas
[RFP-1739] c06 N72-17099

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Contamination growth and effect on high resolution contrast
[COO-2110-1] c14 N72-17440
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Time resolved emission measurements of atomic line and continuum radiation channels behind incident shock wave
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CONTRACTS
Analysis of benefits resulting from incentive type contracts by governmental agencies and comparison with other contracting methods
[AD-732909] c34 N72-17982
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Application of control and estimation theory in design of stochastic and deterministic chemical controllers
[AD-732928] c06 N72-17106
CONTROL THEORY
Design of helicopter stability and control augmentation system using optimal control theory and computerized simulation
[AD-732911] c02 N72-17013
Application of control and estimation theory in design of stochastic and deterministic chemical controllers
[AD-732928] c06 N72-17106
Annotated bibliography of methods for analysis and synthesis of distributed parameter systems - Parts 1 and 2
[AD-732931] c19 N72-17557
CONVECTIVE HEAT TRANSFER
Fabrication and testing of improved repeatable, high porosity turbulators for augmenting heat transfer in cylindrical tubes
[AD-732464] c33 N72-17965
COOLING SYSTEMS
Radial heat flux transformer for use in heating and cooling processes
[NASA-CASE-NPO-10828] c33 N72-17948
COPPER
Torsion technique for measuring dislocation mobility in copper and zinc at 44 K
[CALT-767-P-3-16] c26 N72-17826
COPPER ALLOYS
Effects of composition and temperature on electrical resistivity and elastic moduli of Cu-Cu3Au alloys
[IS-T-478] c17 N72-17509
COPPER FLUORIDES
Method to produce high purity copper fluoride by heating copper hydroxyfluoride powder and subjecting to flowing fluorine gas
[NASA-CASE-LEW-10794-1] c06 N72-17093
CORE SAMPLING
Direct shear method for analyzing vane and direct shear strength of marine sediments taken from San Diego Trough
[LMSC-D244610] c32 N72-17931
CORRECTION
Methods for g factor correction for hydrogen-like atoms
c24 N72-17398
CORROSION RESISTANCE
Long time corrosion resistance of annealed austenitic CrNi steels and nickel based alloys in superheated steam
[EURFNR-911] c17 N72-17519
CORROSION TESTS
Characteristics and application of electric meter for measuring degree of corrosion
[AD-732525] c14 N72-17446
Plutonia and curia compatibility with refractory alloy containers
[MDC-3124] c22 N72-17744
CORRUGATED PLATES
Shear stiffness of trapezoidally corrugated plate with discrete attachments to rigid flange at ends of corrugations
[NASA-CR-1966] c21 N72-17591
COSMIC PLASMA
Research projects in cosmic physics, technical applications of plasmas, and methods for plasma diagnostics
[NP-19064] c25 N72-17818
COSMIC RAY SHOWERS
Ionization calorimeter for measuring horizontal flux in cascade showers
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COSMIC RAYS
Monte Carlo nucleon-meson cascade calculations for cosmic and solar proton transport in iron, tissues, and moon
c24 N72-17616
Chemical composition and energy spectra of primary cosmic radiation
c29 N72-17627
Identification of transuranium element of cosmic radiation in earth magnetic field and prediction of behavior of trapped particles as function of flux and energy distribution
c13 N72-17672
Expected frequency of light flashes due to Cerenkov radiation, determined from fluxes and energy spectra of galactic cosmic ray helium to iron nuclei
c29 N72-17703
Galactic and solar cosmic radiation dosage to flying personnel and passengers onboard SST
c13 N72-17721
Absolute cosmic ray, free air ionization and charged particle fluxes and dose rates in atmosphere
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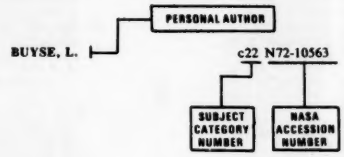

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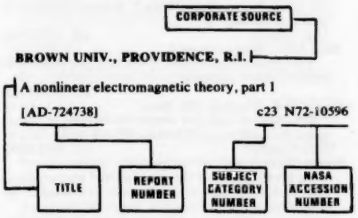

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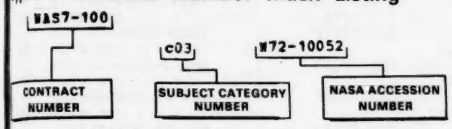

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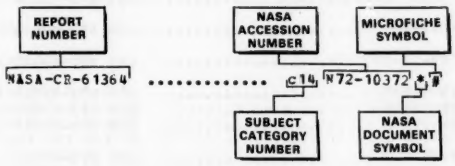

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